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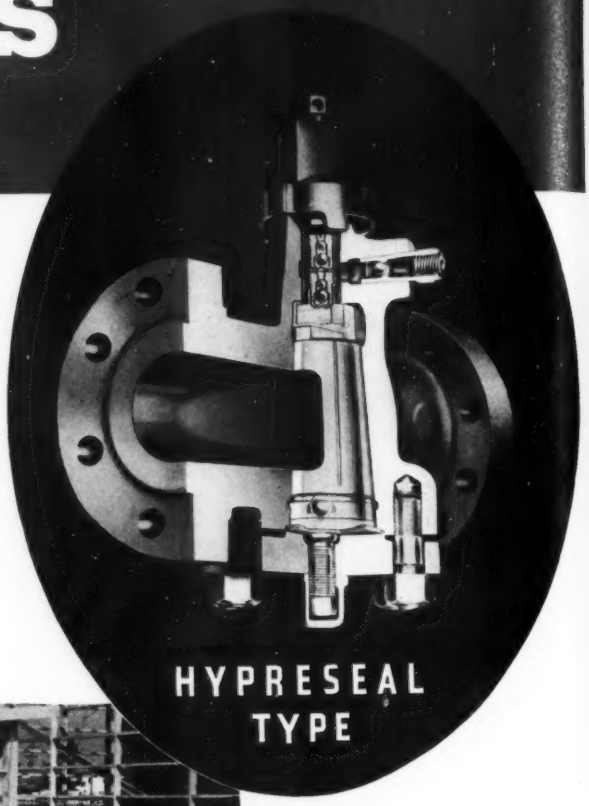

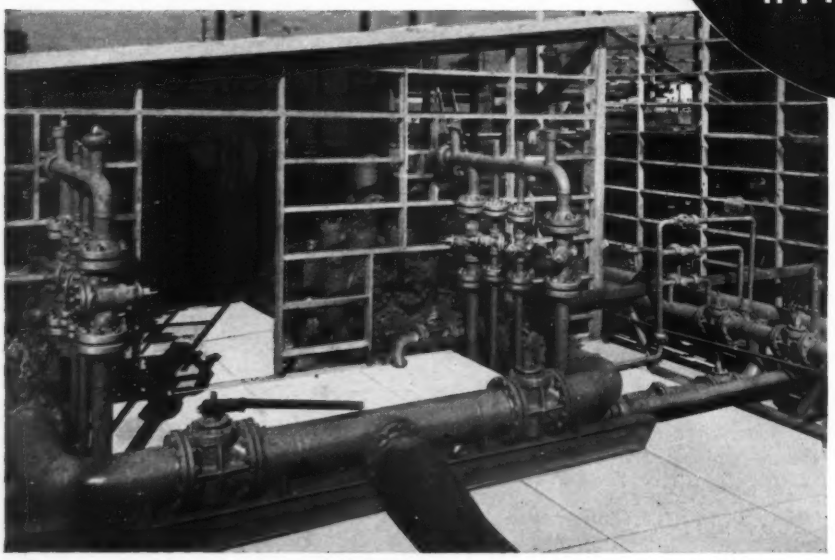

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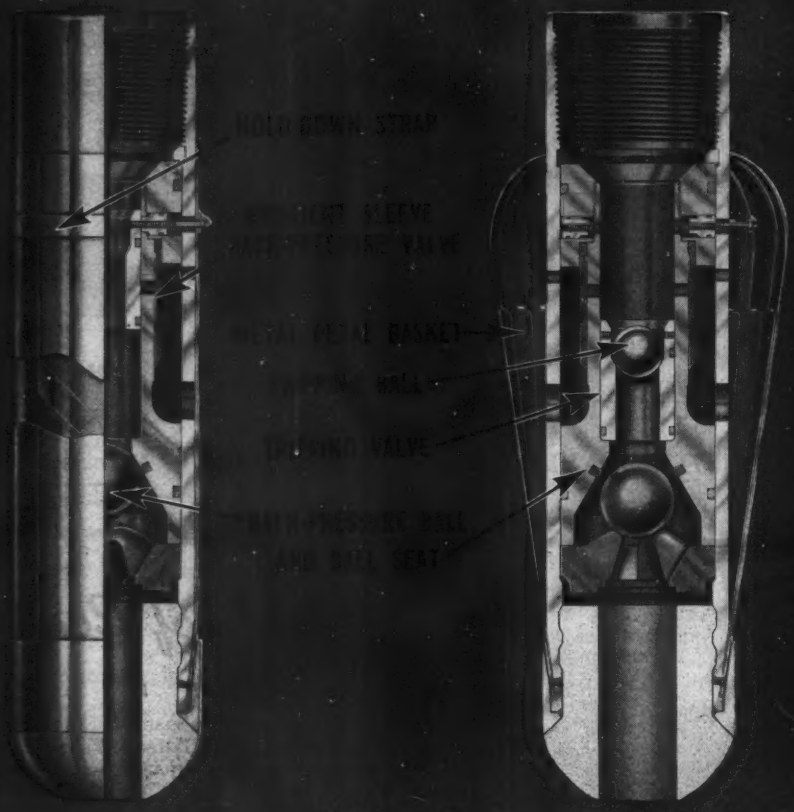

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An Immediate Challenge

A WEEK ago this page reflected the viewpoints of those who feel the time has arrived for the formulation of a natural-gas policy in keeping with the rapidly expanding activities of that industry.

Within the past few days companion bills have been introduced in the Senate and House providing for revisions in the Natural Gas Act, an essential step in any permanent program looking to the establishment of sound policies in the production, transportation, and distribution of natural gas.

In his column, "Watching Washington," the Journal's Henry D. Ralph in this issue outlines the difficulties to be overcome if favorable action is to be obtained by this session of Congress. This legislative situation presents a challenge to both the oil and gas industries.

The intent of the proposed revisions is to leave no doubt in the future as to where the authority of the Federal Power Commission, as regards natural gas, starts and where it ends.

Any regulation of the production and the intrastate gathering of gas should rest with the states, where actions are based on conservation practices and not price controls. On a basis of recent decisions which so far have been supported by the courts, many operators hesitate to enter into agreements involving the sale of field or residue gas which ultimately becomes part of an interstate movement. Furthermore, a commission which insists that it has the right to consider gas-production costs in arriving at earnings upon which rates are based, will not hesitate to go a step further and also include the oil that is produced with the gas.

The conservation commissions must have a free hand to work with producers to the end that all forms of gas wastage are ended. That is not possible if the FPC controls are permitted to extend to the well head. Remove this federal encroachment and there is every reason to believe that the state bodies working with the operators will confine the flaring of gas to a few fields where the volume involved is unimportant.

The proposed revisions will assure the same freedom in the sale of gas to distributors and consumers as in production and gathering. Framers of the original natural-gas act never intended that FPC should determine who should use the many services of the natural-gas industry and how.

Natural-gas and oil operations with the assistance of consumers working individually and through associations are in a position to call the urgency of these matters to the attention of Congress from all parts of the country. Aside from its direct significance in natural-gas and oil operations, the legislation is of primary importance as a contribution to the plans of the Eightieth Congress to end vicious governmental practices of the past few years which have no part in the reestablishment of a sound national economy.

Contract Awarded for Construction Of Michigan-Wisconsin Line

NEW YORK.—Ford, Bacon & Davis, Inc., has been awarded a contract by Michigan-Wisconsin Pipe Line Co. and Austin Field Pipe Line Co., to design and supervise construction of a 26-in. natural-gas pipe-line system, extending from North Texas to Detroit, Milwaukee, and other cities in Wisconsin, Michigan, Iowa, and Missouri. Authorization for construction of the line was recently given by the Federal Power Commission.

About 250,000 tons of steel pipe will be used, and the initial construction cost will be upwards of $52,000,000. The ultimate cost is estimated at $85,600,000.

Maximum capacity of the line reportedly will be 325,000,000 cu. ft. daily. This compares with an estimated 425,000,000 cu. ft. daily which Texas Eastern Transmission Co., successful bidders for the Big and Little Big Inch pipe lines, plan to run through both lines. When ultimate capacity is reached on the Michigan-Wisconsin line, there will be about 142,500 hp. of compressor capacity installed in 14 stations.

A. O. Smith Corp., Milwaukee, will roll the large-size pipe. Initial capacity of the line will be 162,500,000 cu. ft. daily. Length of the main section from Texas to Joliet will be 809 miles. Booster stations will be at about 80-mile intervals, but definite locations have not yet been decided.

An aerial survey for a right-of-way is scheduled to start at once, and actual construction is expected to be under way sometime in the latter part of this year. Total length of the system will be about 1,800 miles. Ford, Bacon & Davis state that when the line is completed it will probably be the largest and longest natural-gas pipe-line transportation system ever to be built as a single operation.

The main line is to start from a point near Guymon, Tex., in Hugoton gas field and extend in a generally northeasterly direction to a point near Joliet, Ill. From this junction, one main line branch will extend north into Wisconsin, where it is planned to serve Milwaukee, Madison, and other cities, and a second branch will run around the lower end of Lake Michigan and then turn northeast to Austin gas storage field near Grand Rapids and on to Detroit.

In Michigan, plans indicate that it will also serve Muskegon and Ann Arbor, as well as Grand Rapids. The Austin gas field will be used for storage purposes.

Edgar G. Hill, vice president of Ford, Bacon & Davis and of Ford, Bacon & Davis Construction Corp., will be in charge of operations.

The application granted Michigan-Wisconsin November 30 has been strongly contested by Panhandle Eastern Pipe Line Co. which contends it has rights under the "grandfather clause" of the Natural Gas Act to serve the Detroit area.

Panhandle took the case to court February 7 when it asked the U. S. Court of Appeals in the District of Columbia to set aside the FPC order granting the certificate to Michigan-Wisconsin.

Panhandle suffered a reverse in the litigation last week when the court refused to stay further proceedings in the case pending the court's action on the appeal from the order. John W. Scott, one of Panhandle's attorneys, said no date has been set for a court hearing on the appeal itself.

Parsons Company to Survey U. S. Plants

RALPH M. PARSONS CO., engineering firm of Los Angeles, will make a complete economic and engineering survey of all remaining government-owned aviation fuel and other wartime refining plants and facilities, it was learned this week. The survey will evaluate the plants not yet absorbed by the industry on the basis of worth to the industry as an industry-owned facility.

The group of plants to be studied includes those facilities remaining in 22 refineries. Reports indicate that some of these units may be economically useful to companies operating them during the war; some may be more useful when disposed of for dismantling and reerection at other locations, while others may be cannibalized.

The refining units under study include at least 18 catalytic-cracking units, Fluid, Houdry, and Thermofor processes; 19 alkylation plants, including those using hydrofluoric acid catalyst and those using sulfuric acid catalyst; and 15 butane-isomerization units, all using anhydrous aluminum chloride catalyst, so far as known. The wartime contract prices of these units total nearly $250,000,000, according to a list of the plants published in The Oil and Gas Journal, February 22, page 117.

The final report on the entire project is to be made within 90 days after the date of the contract or 90 days after all previous reports and data have been delivered by the Government to the contractor. In the meantime, special reports are called for on six special plants on which, presumably, negotiations for disposal have progressed far and which should not be delayed until the final report is made on the whole project. Presumably values placed on these properties will govern the disposal of the plants.

Allan H. Hand, former secretary of the Petroleum Industry War Council, is vice president of the Parsons company and in charge of its Washington office.

Stanolind Buys 121 Slaughter Field Wells

Stanolind Oil & Gas Co. has acquired the producing properties of J. C. Hawkins, L. M. Glasco, and J. A. Humphrey in the Slaughter pool, Hockley and Cochran counties, Texas, for an undisclosed cash consideration.

The properties consist of approximately 5,000 net producing acres, 121 wells, and the leases are burdened with an oil payment of $5,730,000 payable out of seven-sixteenths interest. The total monthly allowable oil from the combined properties purchased is approximately 63,000 bbl.

The purchase boosted Stanolind's number of wells to more than 400 in the field, which has approximately 2,000 producers and is the second largest field in the state.

Jersey, Socony-Vacuum To Terminate Intava

Announcement has been made of plans by which Standard Oil Co. (N. J.) and Socony-Vacuum Oil Co., Inc., will terminate by the end of 1948 the agreement under which these two companies have jointly provided aviation products and services throughout the world outside of the United States.

Under these plans, which would not affect existing contracts or services, the activities of Intava, Inc., the jointly owned management and service affiliate of the two companies, will be terminated over approximately a 2-year period. During this time, facilities and services will be absorbed by marketing affiliates of either of the two parent companies which thereafter will conduct aviation business independently.

Legislation Curbing FPC Gathers Widespread Industry Support

by Henry D. Ralph

WASHINGTON. — General revision of the Natural Gas Act to correct the chief complaints of the oil and gas industry against the way it has been administered by the Federal Power Commission is contemplated by legislation introduced in both houses of Congress during the past week.

The measure has general industry support since it was drafted by the Independent Natural Gas Association and attorneys for other groups and individual oil and gas companies. It was first introduced in the House by Rep. Ross Rizley of Oklahoma (H.R. 2185), February 24. An identical bill was introduced the following day by Rep. H. H. Carson of Ohio (H.R. 2235), and a companion measure was introduced in the Senate on February 28 jointly by Sen. E. H. Moore of Oklahoma and Sen. Homer Ferguson of Michigan (S. 734). In both chambers the bills were referred to the committees on interstate and foreign commerce.

Chief purpose of the bill is to limit the commission's jurisdiction over the natural gas industry. It would, briefly, prevent FPC from (1) controlling in any way the "end use" to which gas is put, (2) regulating direct sales to industrial consumers, (3) regulating production and gathering of natural gas, or (4) regulating local distribution of gas.

In fixing rates, FPC would be required to accept the field price of gas instead of its formula for determining original cost of gas reserves, and to base rates on the value of properties used in interstate transmission only and excluding other property owned by the company but not under FPC jurisdiction.

The bill also requires FPC to expedite proceedings in applications for new construction, particularly minor extensions and uncontested applications.

In introducing the bill Representative Rizley said "it is the result of the composite judgment of every segment of the natural-gas industry and is deemed to be absolutely necessary to the welfare of the consumer, the producer, the transporter, and the distributor."

"The need for this legislation," he added, "arises because the Federal Power Commission, as have numerous other regulatory agencies of the federal Government, has, during the past 15 years, reached out beyond the limits set for it by Congress in legislation and has imposed undue burdens on an industry which has rendered magnificent service, despite the bureaucratic red tape and regulation. The result has been that the industry has been hamstrung and the consumers and potential consumers have been unable to obtain adequate supplies of natural gas."

Senator Moore described the purpose of the bill as defining clearly the jurisdiction of the Federal Power Commission in connection with the administration of the act, adding:

"Regulatory policies which the Federal Power Commission has gradually introduced are far in excess of the authority which the Congress provided and have been detrimental to the expansion of the industry, and consequently, injurious to the public. It was not the intent of the members of Congress to grant the sweeping authority that has been assumed, as is evident from the legislative history and from the language of the act itself. It is now necessary to bring the commission back by positive, affirmative action to the course which Congress meant for it to follow. The fact that the commission has been sustained in its illegal actions by some court decisions makes it more imperative that Congress declare clearly and unmistakably just what are the powers and duties of the commission."

Brown Requests Support

Support of the bill by all oil producers has been requested by Russell B. Brown, general counsel of the Independent Petroleum Association of America, to cure what he described as a long-standing problem in the industry—the seizure by the FPC of authority over the natural-gas industry and, as an incidental effect, over oil production as well.

The bill spells out what is and what is not within the jurisdiction of FPC. It states that the act applies to the transportation of natural gas in interstate commerce and to the sale, after interstate transportation, for resale for ultimate public consumption for any use. This means that direct sales to an industrial and other consumer, not for resale, are exempt from regulation.

Natural gas subject to FPC control is defined as "either gas in its natural state as produced from the well, or residue gas from gas in its natural state, from casinghead gas or from other gaseous substance after extraction of hydrocarbon liquids, or any mixture of natural and artificial gas." This is designed to prevent future confusion over the products within FPC jurisdiction.

Since the act gives FPC jurisdiction over "natural gas companies," this term is defined by the bill to include only interstate transportation and sale for resale, thus excluding the producing activities of an interstate carrier.

To make certain that there will be no misunderstanding of the intent of Congress regarding the limits of FPC jurisdiction, the bill defines in detail the terms "production," "gathering," "transportation," "sale," and "local distribution." For instance, "production," which is excluded from FPC jurisdiction, is defined to cover recovery of residue gas, or the extraction from natural gas of hydrocarbons or other chemicals either prior or during interstate transportation, and includes sale to a trunk line whether the sale is made in interstate or intrastate commerce. Production facilities are defined to include leaseholds, extraction plants, and other facilities incident to production, and gathering facilities include anything used prior to physical delivery of gas into a trunk line.

FPC jurisdiction over sales is expressly limited to sales for resale after interstate transmission. This is to offset the commission's recent assumption of jurisdiction over sales for interstate transmission made prior to interstate movement.

In fixing the pretransmission value of natural gas for purposes of rate regulation, FPC is directed to allow as an operating expense the actual price paid to nonaffiliates.

The following analysis of the measure was prepared by the Independent Natural Gas Association of America. *(Other comments on the proposed legislation will be found under Watching Washington, page 39).*

"To insure a larger and more constant supply of gas to consumer areas, the problems of the entire natural-gas industry, production, transportation, and distribution, which have been confronting it in recent years can, in a large part, be solved by the adoption by the Congress of the amendments proposed. These amendments to the Natural Gas Act are the result of the composite judgment of every segment of the natural gas industry and are deemed to be absolutely necessary to the welfare of the consumer, the producer, the transporter, and the distributor.

Section 1—End Use

"The Federal Power Commission has undertaken, in many instances, to assume jurisdiction to direct the end

use of natural gas. Coal and railroad interests for years urged the commission to take this action. In the investigation (Docket C-580) the same interests urged 'end use' on the commission. The last clause of Section 1 provides that the commission shall not prohibit or restrict the transportation or sale of gas in interstate commerce for any purpose for which such gas may lawfully be used. That is, if the sale is lawful under state law, the commission cannot restrict the use of the gas even though there is coal in the area. This also means the Federal Power Commission would have no jurisdiction over direct industrial sale by either the pipe line or the distributor.

Production and Gathering

"The Federal Power Commission has asserted jurisdiction over the production and gathering of gas in spite of the fact that the Natural Gas Act excludes that jurisdiction. The courts have sustained the commission in claiming jurisdiction over production and gathering, for the purpose of rate making. The latest decision is the Interstate case in the Fifth Circuit Court of Appeals, now on certiorari in the Supreme Court. This decision granted the commission full jurisdiction over production and gathering, including the cost of gas purchased by the pipe line as well as gas produced by it—in other words, jurisdiction to the well head. Section 1(b) redefines the exclusion of production and gathering and makes exclusion mandatory in rate cases. This is necessary because the result of the Interstate case would make a natural-gas company out of every independent producer or oil producer who furnishes the least quantity of gas to an interstate pipe line. This would subject the independent producers and oil companies to the jurisdiction of the Federal Power Commission, its code of accounting and limit the profits of the independent producers to the 6 or 6½ per cent limit allowed the pipeline companies. The amendment cures that defect in the law.

Jurisdiction Over Pipe Lines and Distributors

"There has been doubt and argument about the administration of the Natural Gas Act as to when jurisdiction of the Federal Power Commission begins and ends whether it begins at the well head and continues to the burner tip, from the inception of the production of the gas to its use by the consumer. (Section 1(b) of the amendment expressly defines jurisdiction to begin at the inlet (after production and gathering) where the gas enters the trunk transmission line of the interstate pipe line and ends that jurisdiction at the outlet of the trunk transmission line, that is, the point of delivery to the distributor. It is contended that that is the original intent of Congress and the amendment settles all doubt on the subject of jurisdiction of the Federal Power Commission.

"Likewise there has been serious conflict as to the jurisdiction of the commission over facilities. Section 1(b) of the amendment denies the commission jurisdiction over facilities for production and gathering, treating and processing of natural gas and denies jurisdiction of the Federal Power Commission over local distribution and local distribution facilities. This in furtherance of settling the question of the extent of the jurisdiction of the commission. This is further amplified in Section 1(c) of the amendments which specifically requires that the limitation of jurisdiction shall control all other provisions of the act.

Definition of Natural Gas

"To avoid conflicts existing in present law, it is necessary to define natural gas as is done in Section 2 of the amendments, to include not only gas in its natural state but in its processed forms, including mixed gas.

"To complete the limitation of jurisdiction, Section 3 provides that a person becomes a natural-gas company only after the commencement of transportation (of his or its gas) in an interstate pipe line for sale for resale and only to the extent the said person is engaged in interstate transportation. In other words, interstate wholesalers of natural gas for resale are subject to the jurisdiction of the Federal Power Commission but producers are not.

Definitions of Facilities, Etc.

"To make certain of the exclusion in Section 1(b) of the amendments so that it will not be possible for hair-splitting definitions to circumvent the plain intent of the law, several terms are specifically defined. Section 4 makes these definitions. Section 10 thereof defines production and production facilities and relates production to transportation, to interstate commerce and intrastate commerce. Subparagraph 11 defines gathering and gathering facilities and as in the definition of production, gathering is related to delivery into inlets of the trunk-transmission facilities. Subsection 12 defines transportation of natural gas in interstate commerce subject to jurisdiction of the commission. In a word, this definition limits the jurisdiction of the Federal Power Commission over such transportation from the point of inlet, for instance, the compressor station or main receiving point and permits that jurisdiction to extend to the outlet or point where local distribution begins. Of special interest to distributors is the last sentence of this subparagraph. Subparagraph 13 defines sale in interstate commerce—after the transportation—in other words, the sale for resale subject to the jurisdiction of the commission when the sale is made after the transportation. Subparagraph 14 defines local distribution and local distribution facilities in the usual sense.

Original Cost and Field Price

"Section 5 eliminates original cost and substitutes field price. The Federal Power Commission has adopted, in rate cases, the philosophy of original-cost depreciated. But this system is unfair to a large segment of the industry, especially in the Southwest. The amendment requires the Federal Power Commission to allow as operating costs, actual prices paid for gas purchased from nonaffiliates and if the gas is bought from an affiliate or subsidiary, then the prevailing current price; if there is no current price, then the fair and reasonable value determined by the ordinary processes. Also, a reasonable cost is allowed for gathering of gas to the inlets of the interstate transmission line.

"It excludes a calculated value for such gas based on the producers investment, thus eliminating original cost depreciated.

"Option: An option is allowed, if timely made, to those natural gas companies who use their reserves as standby, to subject themselves to a rate system based upon original cost depreciated,

Allocation of Costs

"By the terms of the Natural Gas Act (as intended by Congress) and by the terms of Section 5(b) of the amendments, the Federal Power Commission has jurisdiction over transmission lines and sales (inlet to outlet but not over production and gathering, direct sales, etc.). Section 5(b) makes a mandatory requirement on the Federal Power Commission to allocate, prior to fixing the rate base and returns, between the jurisdictional properties, revenues, and expenses over which it has jurisdiction as against those properties, revenues and expenses over which it has no jurisdiction. Many natural-gas companies make the claim that the Power Commission has discriminated in its allocations against nonjurisdictional expenses.

Hearings in Certificate Cases

"Section 6 eliminates the necessity for hearings which are uncontested and requires that contested hearings be set and expedited within thirty (30) days after notice of protest. Under present procedure in certificate cases, delays have been unsufferable. Interventions have run riot. Costs have mounted. Time-killing procedure has been engaged in. The dockets of the Federal Power Commission have bogged down—to the detriment of the industry and the public. These mandatory requirements will speed up certificate cases."

WASHINGTON WATCHING

BY HENRY D. RALPH

Attack on ITO Proposals

WASHINGTON.—Everything which might be construed to give the federal Government authority to regulate production or conservation of petroleum should be taken out of the charter for the proposed International Trade Organization before the meeting of the preparatory commission in Geneva in April, Russell B. Brown, general counsel of the Independent Petroleum Association of America, told the Executive Committee on Economic Foreign Policy last week.

Although endorsing the general objectives of the ITO, Brown found many phrases in the charter which he feared could be used to permit a flood of imported petroleum or could be construed as giving Congress, under the guise of fulfilling international obligations, the power to take over production and conservation regulation now exercised by the several states.

He particularly objected to the stipulation that all countries follow the most-favored-nation policy, declaring that it has been a failure under the reciprocal-trade-agreements program because nontreaty nations get the benefits of our duty concessions without giving anything in return. He also asked deletion of the prohibition against imposition of quantitative restrictions on imports, saying that the import-quota system may be the only way to protect the American oil industry from excessive imports.

In addition to the sections designed to break down tariff barriers, Brown sharply criticized a number of passages dealing with conservation and development of the world's natural resources and providing for international commodity and price regulation. While admitting that these passages are so vague that their intent is unpredictable, he denounced anything that might lead to cartels, an international OPA, or substitution of national or international controls for state regulation of the oil industry.

Prospects of Passage

THE amendments to the Natural Gas Act introduced in both Senate and House last week are well sponsored, but prospects of enactment this year are not too bright.

The first attempt at action will be made in the House, since the basic statute originated in that body, and Representative Rizley will press for early hearings before the committee on interstate and foreign commerce. He is not a member of this committee, though Representative Carson, who introduced an identical bill, is. However, this is a very busy committee with jurisdiction over many subjects. Moreover, the present disposition of House leadership is to keep legislation to a minimum in the hope of ending the current session early in the summer.

If the House committee delays action the senatorial sponsors promise to try for initial hearings on their side of the Capitol.

The measure is frankly an industry bill and two of its sponsors, Moore and Rizley, are from the gas-producing state of Oklahoma, a fact which may be used against it. Balancing this, however, is the fact that cosponsors are from the gas-importing states of Ohio and Michigan. Senator Ferguson and Representative Carson both have reason to want the act amended because of difficulties their constituencies have had with Federal Power Commission.

Greatest hindrance to speedy action will be a general disposition on the part of Congress to await the report of the commission in its general natural-gas investigation (Docket G-580). This is not due for some 3 months at least, too close to the scheduled congressional recess to permit legislation.

This investigation covered all the matters included in the bill, and the report is supposed to contain the commission's own recommendations for revising the act. Undoubtedly the commissioners will oppose much of the bill, and if called on to testify now they quite likely would ask Congress to delay action until their study is completed.

More opposition probably will come from self-styled spokesmen for consumers, particularly those groups which habitually favor more federal regulation of business rather than less. However, the public officials of a good many gas-consuming cities and perhaps several state regulatory bodies can be counted on to support the measure. Actually, a strong case can be made that the bill will benefit consumers by reducing costs through elimination of red tape and regulation and by making it easier for more gas to be placed in interstate commerce.

An Aroused Industry

THE Federal Power Commission itself is the real father of the new bill to revise the Natural Gas Act.

In the first place FPC stretched and twisted the law to extend its jurisdiction beyond the obvious intent of Congress, thus arousing the demands of industry for legislative clarification.

In the second place its prolonged natural-gas investigation resulted in unifying industry opposition and crystallizing the complaints into specific amendments.

The classic history of federal regulation is for Congress to enact a statute in rather general terms and turn it over to a commission to administer. Case by case this commission then builds up a body of precedents and decisions which fill out the details and interpret the law to specific applications. From time to time an appeal to the courts either upholds or modifies the commission's views. In the early days the federal courts were pretty strict in holding a regulatory commission to the letter of the statute, but in recent years there has been a general disposition to give regulatory agencies the benefit of every doubt, particularly in cases involving anything construed as being "interstate commerce."

The Natural Gas Act is a relatively young statute, and its terms are not as all-inclusive as many other laws passed by Congress, but the FPC lost little time in attempting to extend it as broadly as any other federal law has been applied. In this it has had phenomenal success in being sustained by the courts which, it would appear, have paid less attention to the wording of the Natural Gas Act than to the latter-day broad concept of "interstate commerce."

It recently became obvious to the industry that neither the FPC itself nor the federal courts could be counted on to confine the law's application to the expressed intent of Congress, and several of the latest decisisons point the way toward detailed FPC regulation of every phase of the gas business from well to burner-tip. So the demand for legislative relief swelled.

Even so, the gas industry might not have united on a set of amendments had it not been for the FPC investigation. The commission was well aware of the industry's dissatisfaction, and one announced purpose of the investigation was to formulate possible amendments to the law. Quite likely the commission hoped to keep control of the situation in this way and to be able to draft the amendments itself, particularly since the

(Continued on page 56)

International

WORLD-WIDE OIL DEVELOPMENTS

Venezuelan Discovery Rate Tops Production, Proudfit Says

CARACAS.—Proved reserves in all areas thus far explored in Venezuela total more than 7,500,000,000 bbl. and oil is now being discovered at a faster rate than it is produced, Arthur T. Proudfit, president of Creole Petroleum Corp., told a recent press conference.

Creole has located oil amounting to more than its 1946 production through the discovery of additional reserves in fields already under development, Proudfit said. He added that no new fields have been discovered during the last year.

"So far, we have not discovered any oil in our concessions in Guarico, North Monagas, or West Zulia," Proudfit said. "The board of directors, however, has decided to continue the exploratory work in the above-mentioned areas during the current year. Our exploration budget for this year is the largest in the history of the company. About $10,000,000 will be expended for exploration.

"Our production has increased by 10 per cent since January 1. We are producing at the rate of 600,000 bbl. daily."

Proudfit told of efforts being made to conserve gas. For this purpose, he said, a repressuring plant has been built at Quiriquire, and construction of a stabilization plant has been started at Jusepin.

Creole will invest about 160,000,000 bolivars (about $48,000,000) during the current year, in new plants and operations, he said.

Proudfit discussed a tentative project calling for the laying of a water line from the State of Falcon to the site of the new Creole refinery in the Peninsula of Paraguana. The pipe will be of concrete, cast iron and steel, and the concrete line will aid in solving the corrosion problem. The projected water works will cost the company about $4,000,000, he added.

Reviewing other activities of the company, Proudfit disclosed that: The preliminary survey of the Zulia-Annuay (Paraguana) pipe line has been completed. Equipment is being readied to begin clearing the ground. This work will begin next July.

The length of the line will be 223 km. (140 miles.) The diameter of the pipe will be 24 to 26 in. The line will run from Ule, near Tia Juana, to Amuay, and will have a pump station at the above-mentioned point, and another one midpoint between the two terminals. Light oil will be pumped through this line, and heavy oils will be shipped by tanker to the refinery.

In spite of the shortage of materials, the company expects to have the refinery built within the next 2 years. A temporary dock is being built at Amuay. A concrete pier will be built at a later date.

During 1946, the company spent more money than at any previous time, for welfare, housing, and other facilities for its employes. A total of 887 homes were built or were in process of construction at the end of the year.

A total of 4,389 children received education in the company schools in 1946, an increase of 33 per cent over the 1945 figure. The Creole educational program has helped to reduce illiteracy among the company's personnel from 82 per cent in 1938 to the present figure of 12 per cent.

Medical assistance has been expanded; 256,885 persons were treated; 8,857 persons were hospitalized in the 15 hospitals, clinics, and dispensaries operated by the company.

The company built, in the past year, 129 km. (85 miles) of roads, and cooperated with other companies in the building of 225 (130 miles) of additional roads. The company now has 1,600 land vehicles, 269 water craft, and 3 planes.

Sinclair Panama to Begin Panama Test in May

Sometime this May, Sinclair Panama Oil Corp. plans to spud in for a test on Panama's Colombus Island, located about 150 miles northwest of Cristobal. Sinclair Panama is jointly owned by Cities Service Co. and Venezuelan Petroleum Co., the latter an affiliate in which Sinclair Oil Corp. owns 85 per cent. A drilling rig and other equipment is now en route to Colombus Island.

Last October (The Journal, October 5, page 42) it was announced that the Sinclair Panama company had acquired a 20-year concession to explore and produce petroleum in Panama. The concession covers 7,250,000 hectares (approximately 17,762,000 acres). Provisions for a 20-year extension is part of the agreement.

Both Cities Service and Sinclair have had previous experience drilling in Panama, Sinclair having struck gas years ago in a test drilled on Colombus Island.

S. N. Marep to Close Washington Office

S. N. Marep (Societe Nationale de Material pour la Recherche et l'Exploitation du Petrole), private French purchasing company, will close its Washington office sometime in March and conduct all future business through its New York office at 44 Beaver Street.

Since Marep opened its offices in this country in November 1945, a total of 297 French Government contracts have been made, representing $5,730,000 worth of oil-field equipment. This equipment was purchased for exploratory and development work in west and north Africa, as well as in France. Material for about 80 per cent of the contracts has been delivered. The New York office will handle all future matters relating to unfulfilled contracts.

P. E. Abadie, who was in charge of Marep's Washington office, will be stationed in New York for a time, following which he plans a trip to Texas and then he will return to Paris. Marcel Schwob remains in charge of the New York office.

Russia Makes Partial Payment On Austrian Oil Claims

THE first positive indication that Russia admits British and U. S. ownership of certain Austrian oil properties was received by Socony-Vacuum Oil Co., Inc., here this past week when the Soviet Government announced the payment of 5,000,000 schillings (about $500,000) to Socony-Vacuum and Royal Dutch-Shell foreign interests. Previously, Russia promised to pay 10,000,000 schillings ($1,000,000) of the 40,000,000 schillings ($4,000,000) which the companies figures the Soviet owes them.

This partial settlement, however, was not made until after long negotiations between the oil companies and the Soviet occupation officials in Austria and after the U. S. State Department formally pressed the matter in Moscow. Just when and if the remainder will be paid is not known.

Since the occupation by Russia of the Zisterdorf oil field and other oil properties owned by Socony-Vacuum, Shell and the Robert Van Sikle interests in Austria the Soviets have taken the full production of fields and refineries, refusing to admit that such action was contrary to the Potsdam Agreement. In fact, Russia has held that the oil properties, seized by the Nazis from the Austrians was legitimate war booty—even though Russia signed postwar agreements stating that where property was transferred to the Nazis under duress, it would be returned to the rightful owners. The fact that the Russians have now made a token payment is interpreted as an indication that Russia admits the error of her previous stand.

Companies benefitting from the payment include "Rag" (abbreviation of Rohoelgewinunngs Aktien Gesellschaft), jointly owned by Shell and Socony-Vacuum; Floridsdorf Mineral Oelwerke (Shell); and Vacuum Oil Co. Previously, Russia made a payment to the Tiefbohrungs Unternehmen, owned by Van Sikle, after the latter threatened to shut down operations unless some token payment was made. Since the war, the companies have been allowed to operate their own properties, but the Soviets control the destination of the oil produced and refined.

The last official word the oil companies, which own the Austrian oil properties, had from the Soviet—prior to the token payment—was that such payment would be held up pending the disclosure of certain confidential oil-company information about finances, wages and costs. The companies flatly refused to comply with this request, and apparently the Russians have now forgotten it.

For more than a year, U. S. oil claims have been vigorously pushed by Gen. Mark W. Clark in discussions with the Russian commander in Austria, Gen. L. V. Kurassov.

International

Chinese Imports From Abadan Indicated

The probability of China importing petroleum products from Anglo-Iranian Oil Co., Ltd.'s Abadan refinery was indicated in a recent Reuters' dispatch from Shanghai announcing the formal establishment of China Petroleum Co., a subsidiary of China's National Resources Commission.

Approximately 22 ships, tankers, and cargo vessels, are expected to transport petroleum products from foreign countries—probably largely from the Persian Gulf for the time being—to China.

Meanwhile, speculation in the United States as to exactly how Generalissimo Chiang Kai-shek's recent announcement to get government out of industry would affect oil has indicated interest in some quarters. From the best available sources in New York, it appears that the Chinese Government, while continuing an active interest in developing that country's petroleum resources, will permit a greater degree of private participation than had been planned previously.

Cities Service Sells Four Subsidiaries to Pemex

The property of four Cities Service Co. subsidiaries in Mexico has been sold to Petroleos Mexicanos (the Mexican Government Oil Administration), according to Antonio J. Bermudez, director general of Pemex.

Mexican Oil Co. a subsidiary of Gulf Oil Corp., is now the only U. S. oil concern still operating in Mexico. The Cities Service subsidiaries were: Mexican Eastern Oil Co., Compania de Terrenos Petroliferos Imperio, Mexico-Texas Petroleum & Asphalt Co., and Sabino Gordo Petroleum Corp. Most foreign oil companies in Mexico were expropriated in 1938.

Trinidad Leaseholds Production

Crude-oil production of Trinidad Leaseholds, Ltd., from its own fields only during January totaled 558,890 bbl. for a daily average of 18,029 bbl. This represents an increase over the December production of 522,087 bbl. with a daily average of 16,841 bbl. November daily average was 17,691 bbl.

Three officials of the Egyptian Government, together with two oil-company executives, last week toured oil installations in the Houston district after attending a meeting of the Petroleum Committee of the International Labor Organization in Los Angeles. Pictured here are: N. Lanyi, formerly assistant manager for Socony-Vacuum Oil Co., Inc., in Cairo and now with Magnolia Petroleum Co. in Dallas; Mohamed Aboulezz Bey, member of the Egyptian Congress and assistant manager of Socony-Vacuum properties in Egypt; Hanafi Fahmy Bey, deputy director of the Egyptian Department of Mines and Quarries; Ibrahim Ezzat Bey, labor attache in the Egyptian Embassy in Washington; and Duncan R. MacIntosh, general manager in Egypt for Anglo-Egyptian Oilfields, Ltd. (Shell)

Expansion at Haifa Refinery to Result in Capacity of More Than 100,000 Bbl. Daily

PROVISIONS to handle more crude when the new line to Haifa will be in operation are now being made at the Haifa refinery of Consolidated Refineries, Ltd., which has just begun a major expansion program, as a result of which the capacity will be stepped up to over 100,000 bbl. daily. In addition a complete lubricating-oil plant will be constructed. The entire expansion program will be completed in about 2 years.

Consolidated Refineries, which is jointly owned by the Anglo-Iranian Oil Co., Ltd., and Anglo-Saxon Petroleum Co., Ltd., (Shell), began production shortly after the outbreak of war in 1939. The refinery was constructed by the M. W. Kellogg Co. which completed the first two crude-distillation units by the end of 1941. At the end of 1939 one crude-topping unit, two treating units, certain tankage and a temporary battery of rig boilers were ready, and 1 year later an acid plant, two more treaters, one rerun unit, one acid-tar unit, and one boiler in the boiler house were put into operation. During 1941 the topping side of the second crude unit went into operation, the power house was completed, and the gasoline-stabilizer unit was installed. In the following year this unit and a butane-filling plant were commissioned, and it was decided to revamp the cracking section of both the crude units and to convert them into additional crude-distillation units. This work was completed in the spring of 1943. Other developments at that time included the beginning of asphalt production and the construction of a drum plant for the production of asphalt drums and gasoline containers. Further extensions followed in 1944, when a third crude unit (topping section only), another rerun unit, a second stabilizer and an additional treater unit were constructed.

International
WORLDWIDE OIL DEVELOPMENTS

This article discusses the expansion program now under way at the Haifa, Palestine, refinery of Consolidated Refineries, Ltd., which is jointly owned by Anglo-Iranian Oil Co., Ltd., and Anglo-Saxon Petroleum Co., Ltd. (Shell). The construction program to add additional capacity to the Kirkuk-Haifa and Tripoli pipe lines was outlined in The Oil and Gas Journal March 1, page 46. A third article of this series will deal with exploration work being conducted in Palestine and Trans-Jordan.

Each of the three units has a capacity of some 26,000 bbl. daily. First year of full production with the three units was in 1945, when a total of 4,000,000 tons (30,000,000 bbl.) of crude were put through. This quantity of crude is the maximum which can be carried over the present 12-in. lines from Kirkuk to Haifa and Tripoli. The quantities arriving at the Tripoli end are carried by tankers from there to Haifa Bay, whence they are pumped to the refinery, which is situated 3½ miles northeast of Haifa Port.

During the war, a small amount of crude from the Tripoli terminus was used for the operation of a skimming plant built by French interests at Tripoli. Production of this plant served the local Tripoli market.

The refinery site consists of a roughly rectangular area of 360 acres along the tiny River Kishon, which runs into Haifa Bay. Auxiliary plants in operation include a power station, water-cooling installation, a sulfuric acid plant and an oxygen plant. Steam raising is done by four Spearing high-pressure boilers, each of which produces 150,000 lb. per hour of 500-psi. steam, supplying the power for three turbo-generators installed by the English Electric Co. The generators have a capacity of 6,250 kw. each. The main features of the water-cooling plant are two giant cooling towers, each 250 ft. high and having a diameter of 250 ft. at the base. These towers, which are of the parabolic type, are the highest buildings in Palestine and a landmark of Haifa. They were constructed under patent rights of Film Cooling Towers, Ltd., and 8,000 tons of concrete were used. Each tower is designed to cool 2,000,000 gal. of water per hour. The water which is used in the refinery process is collected in a sump and

General view of the Haifa refinery of Consolidated Refineries, Ltd., showing the distinctive cooling towers at left

pumped up over the cooling towers by pumps of 30,000 g.p.m. capacity each. The water losses are made up by water from wells some 6 miles north of the plant where a special pumping station is in operation.

The extension works now being started provide for a fourth crude unit of the same capacity as each of the present units, so that a total capacity for the Haifa refinery of about 105,000 bbl. daily will be reached in 1949. This unit has been ordered from E. B. Badger & Sons Co., Boston.

Lubricating Plant

Apart from this unit, a lubricating-oil plant, designed to produce over 4,000 bbl. daily of finished lubricating oils of various grades will be constructed. This plant will comprise two vacuum-distillation units with a total capacity of 24,000 bbl. daily of residue from the crude stills and is being designed by E. B. Badger & Sons; two propane-deasphalting units, designed by The M. W. Kellogg Co.; two furfural-extraction units; two M.E.K-dewaxing units and one clay-contacting unit. The latter five units will be designed by The Lummus Co.

Further plant to be installed in connection with these extensions include additional facilities to produce high-quality kerosene, additional tankage of 1,800,000 bbl. capacity, and additional offices, laboratories, workshops, and stores facilities. The power plant will be enlarged by two more generators of 6,000 kw.hr. each, and there will be three new 150,000-lb. per hour steam boilers. It will also be necessary to increase the water supply, and for this purpose two more cooling towers of the same type as the two existing ones, will be constructed and another water supply line will be laid to the wells 6 miles north of the plant.

No estimate for the total cost of the entire program is available, but it is understood that the new investment will by far exceed the cost of the original refinery construction, of some $20,000,000. Owing to currency difficulties, the majority of materials will be purchased in Britain, though all the equipment is being designed in the United States. So far nothing has been shipped to Haifa, but work on the site, where drainage and road constructions have to be carried out, is under way. Provisions for the enlargement were made when the construction of the original plant began, and therefore no additional land beyond the present 360-acre site will be required. Most of the work on the site and the future construction will be carried out by local Jewish and Arab workers under the supervision of small groups of experts from the various companies which provide the equipment.

While Haifa is thus the most important center for oil handling on the Eastern Mediterranean seaboard, and its development during the next 2 years will bring great activity to this busy port, another point on the Palestine Coast, less than 100 miles south of Haifa, is likely to see much oil development in the course of the same period. This is Gaza, a small Arab town, which has been mentioned as a potential terminus for the Arabian-American pipe line from Dhahran, near the Persian Gulf. If Gaza is chosen as a terminus, this will mean large-scale constructions of harbor, loading, and storage facilities there, apart from possible refinery constructions. Moreover the town is situated near one of Palestine's potential oil fields, where drilling for oil is now being carried out for the first time in the history of the Holy Land.

Preliminary surveys, undertaken before the outbreak of World War II, have indicated the presence of oil in the southern part of Palestine, but further work was shelved during the period of hostilities. Following up these geological and geophysical surveys, Petroleum Development (Palestine) Ltd., a subsidiary of the Iraq Petroleum, has brought the required equipment to Palestine and is now drilling in the Gaza subdistrict. The company holds oil-prospecting licenses in the coastal area and in the southern desert of Palestine, known as the "Negev." Other concessions in southern Palestine are in the hands of Jordan Exploration Co., Ltd., whose area is situated at the southern end of the Dead Sea.

The deep drilling now being carried out will prove whether oil in commercial quantities is available in the Holy Land. While no sensational strikes are expected from the present tests, the amount of work and materials so far invested in the exploration of Palestine's resources and the technical data gained in the preliminary surveys suggest that there are good prospects for the development of oil supplies in Palestine.

I. P. C. Officials Say Pipe Line Unbroken

Contrary to reports reaching the United States last week that Palestine terrorists had damaged Iraq Petroleum Co., Ltd.'s 620-mile crude-oil pipe line at both Haifa and at Afuleh, 25 miles southeast of Haifa, Iraq Petroleum officials in Palestine state that there has been no break in the line.

According to earlier dispatches, one of the underground terrorist organizations reportedly admitted inflicting damages by dynamiting the pipe line. This line runs from Kirkuk field in Iraq to Haditha, on the Euphrates River, and then branches off, with one leg going to Tripoli and the other to Haifa.

International

Russia Offers Gasoline At 46 Cents Per Barrel

IN a move which U. S. oil men term "economically unsound," Russia has offered to supply the Syrian and Lebanese governments with any quantities of gasoline desired at 100 piastres ($0.46) a bbl. At present Syria and Lebanon are buying gasoline from Iraq Petroleum Co., Ltd., at 183 piastres (about $0.74) a bbl.

Before coming to an agreement with the Soviets, the Syrian and Lebanese governments are awaiting a reply to a note sent Iraq Petroleum. The Soviet trust, according to a Reuters dispatch from Paris, will sell the gasoline at a price not higher than 46 cents per bbl. To get this gasoline from Russia—probably the Baku area—tankers presumably would pick up loads at Batum, on the eastern shores of the Black Sea, and carry it 1,440 miles to Tripoli, Syria. This is based on the assumption that 10-knot tankers would be used, traveling 240 miles per day.

Russia has a pipe line running from Baku to Batum. The possibility of a line ever being laid overland is practically ruled out, as such a line would have to cross Turkey, and the Turkish Government has not evidenced any desire to cooperate in the past with a Russian-sponsored arrangement.

The Reuters story based on a report carried in the French publication, "Agence Generale Economique et Financiere," adds that U. S. oil men are expected to undertake exploratory work in Syria in the near future.

Lease of Army Equipment In Pacific Discussed

Negotiations between the U. S. Army and four oil companies are now in progress whereby the Army would lease aviation-gasoline equipment on Midway, Wake, Palmyra, and Canton islands in the central Pacific area to the commercial companies. The companies, Standard-Vacuum Oil Co. Asiatic Petroleum Corp., Standard Oil Co. of California, and Union Oil Co. of California, would operate the facilities jointly and would supply the so-called grade 100/130 avgas with 3 m.m. of tetraethyl lead to meet specifications AN-F-48.

Meanwhile, the Army-Navy Petroleum Board is bringing back 11 cargoes (about 1,430,000 bbl.) of surplus aviation gasoline from England to be used by the Army and Navy in the United States.

Committee Plans Distribution of Public Relations Material

PLANS for making available to all branches of the oil business booklets, slide films, and other material which will best tell its story were drawn up February 26 at a meeting of the industry's public-relations operating committee at a meeting in Chicago.

F. WALTMAN

The final meeting, which ended a 2-day session, had as its purpose discussion of means of placing this information in the hands of producers, refiners, transporters, marketers, and other segments of the business.

The committee earlier heard representatives of the Fred Eldean Organization, public-relations counsel, report progress in organizing district committees in Petroleum Administration for War Districts 2 and 3. The committee also heard that program presentations have been made to 19 trade associations and industry groups.

Franklyn Waltman, Philadelphia, director of public relations for Sun Oil Co., presided over the meetings in Chicago. He was elected to the chairmanship previously held by Robert T. Haslam, of the Standard Oil Co. (N.J.), who resigned because of ill health. The committee also elected three new vice chairmen to serve along with Ralph Champlin, New York, of Ethyl Corp. They are Edgar A. Waite, San Francisco, Standard Oil Co. of California; North Bigbee, Dallas, Texas Mid-Continent Oil and Gas Association; and Conger Reynolds, Chicago, Standard Oil Co. (Ind.)

The committee adopted a resolution expressing regret over Haslam's illness and resignation and the hope that he will soon resume his duties as a member of the committee.

The operating committee will meet next in San Francisco April 1-2.

In New York, the organizing committee for PAW District 1 today divided the Atlantic states region into four separate districts to carry out details of the public-relations program.

Meeting at the Waldorf Astoria Hotel, the committee heard its chairman, Robert H. Colley, president of Atlantic Refining Co., Philadelphia, describe broad aspects of the program and emphasize its purpose to represent all segments of the oil business. The committee also received reports of progress made in establishing district organizations in other sections of the country and a description of tools and methods to be used in carrying out the program.

In setting up an organization pattern for 17 states on or near the Atlantic Seaboard and for the District of Columbia, the organizing committee agreed that one district would consist of the six New England states. A second district comprises New York and New Jersey, while Pennsylvania, Delaware, Maryland, West Virginia, and the District of Columbia will be a third. The fourth will consist of Virginia, North and South Carolina, Georgia, and Florida.

Permanent Committee Named

The committee nominated 24 members of a permanent operating committee for New England, 92 for New York and New Jersey, 56 for the area composed of Pennsylvania, Delaware, Maryland, West Virginia and the District of Columbia, and 32 for Virginia, the Carolinas, Georgia and Florida.

Pennsylvania Crudes Advanced 16 Cents

A 16-cent per barrel increase for Pennsylvania-grade crude oil, which leaves the one-time 75-cent Pennsylvania subsidy at only 4 cents for two grades—Bradford and Allegany—has been announced by Joseph Seep Purchasing Agency of South Penn Oil Co.

No increased posting was announced for Corning grade which was advanced 10 cents per barrel November 16.

The new posted prices follow:

Allegany district oil in Bradford Transit Co.	$3.81
Bradford district oil in Bradford Transit Co.	3.81
Bradford district oil in National Transit Co.	3.81
Bradford district oil (Tiona) in National Transit Co.	3.81
Pennsylvania-grade oil in South West Pennsylvania	3.60
Pennsylvania-grade oil in Eureka Pipe Line Co.	3.60
Buckeye — Pennsylvania-grade oil in Buckeye Pipe Line Co.	3.56

Reserves Placed at 24,194,587,000 Bbl. In A.P.I., A.G.A. Joint Report

NEW YORK.—U. S. proved liquid-hydrocarbon reserves totaled 24,194,587,000 bbl. and proved natural-gas reserves were 160.6 trillion cubic feet as of December 31, 1946, according to the American Petroleum Institute and the American Gas Association's first report estimating the nation's petroleum resources.

Of the total liquid-hydrocarbon reserves, 20,873,560,000 bbl. are crude and 3,321,027,000 bbl. are natural-gas liquids. Crude reserves increased 931,714,000 bbl. or about 5 per cent. Condensate reserves are now 1,050,794,000 bbl. compared with 884,967,000 bbl. in 1945.

Proved natural-gas reserves of 160.6 trillion cubic feet increased 12.8 trillion cubic feet from 1945, or about 8 per cent. Estimated net production of natural gas for 1946 is 4.9 trillion cubic feet after deducting the amount of gas returned to reservoirs.

The estimates of the report do not include oil under unproved portions of partly developed fields, oil in untested prospects, oil that may be present in unknown prospects in regions believed to be generally favorable, oil that may become available by secondary methods from fields where such methods have not yet been applied, oil that may become available through chemical processing of natural gas, or oil that can be made from oil shale, coal, or other substitute sources. F. H. Lahee, Sun Oil Co., was chairman of the A.P.I.-A.G.A. committee on petroleum reserves.

The following estimates of proved reserves of crude plus condensate are shown by states (all figures in thousands):

Alabama	785
Arkansas	303,674
California	3,409,948
Colorado	259,830
Illinois	349,620
Indiana	41,243
Kansas	541,846
Kentucky	56,721
Louisiana	1,689,781
Michigan	64,186
Mississippi	267,160
Montana	108,474
Nebraska	500
New Mexico	512,373
New York	81,189
Ohio	29,681
Oklahoma	889,839
Pennsylvania	110,601
Texas	11,470,294
West Virginia	38,630
Wyoming	600,131
Miscellaneous	307

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Liquid always shows black—empty space shows white. Preferred where the liquid level must be easily and positively visible, and when liquids are under high pressure or at high temperature. Made of alloy temperature resisting steel and are highest quality throughout. Liquid chamber made from solid block of steel to assure perfect alignment and rigidity. Conform with A.P.I.—A.S.M.E. requirements.

The "Reflex" is one of the complete line of Penberthy Gages that meet every liquid level gage requirement.

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DETROIT, MICH. Canadian Plant WINDSOR, ONTARIO

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WATER GAGE SET

For oil field, locomotive type and marine boilers. Water shows black — steam shows white; the water level is unmistakable. U-Bolt construction is strongest and simplest to service. Glass replaced by simply removing nuts on face of gage . . . unnecessary to work between gage and boiler. Conforms with A.S.M.E., Federal and State requirements when used for pressures specified by their respective codes.

This is one of the complete line of Penberthy gages that meet every liquid level gage requirement.

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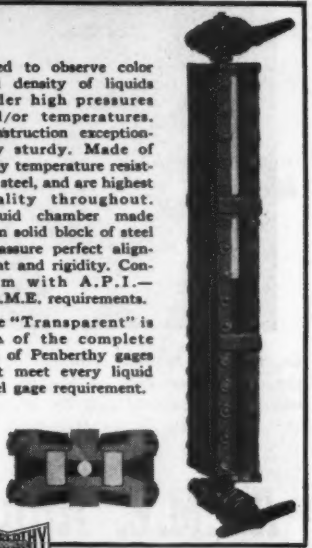

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Dr. Robert E. Wilson, chairman of the board, Standard Oil Co. (Ind.), who will speak at the World Conference on Mineral Resources of the American Institute of Mining and Metallurgical Engineers, and Dr. William N. Lacey, California Institute of Technology, who will receive the Lucas Medal for distinguished achievement in the petroleum industry

A.I.M.E. Anniversary Conference Opens March 17 in New York

THE World Conference on Mineral Resources of the American Institute of Mining and Metallurgical Engineers and the concurrent twenty-fifth anniversary celebration of the institute's Petroleum Division will open March 17 in New York with the week-long program listing some of the top figures of the petroleum industry both in the United States and abroad.

The mineral-resources conference, marking the seventy-fifth anniversary of the A.I.M.E. itself, will involve scientific societies of the United States and some 40 foreign countries. Speakers include Sr. William Frazer, chairman, Anglo-Iranian Oil Co., Ltd.; Robert E. Wilson, chairman, Standard Oil Co. (Ind.); Julius A. Krug, secretary of the interior; and ex-President Hoover, who is a former president of the A.I.M.E. Conference sessions will be presided over by John M. Lovejoy, president, Seaboard Oil Co., and John R. Suman, vice president, Standard Oil Co. (N.J.)

Ex-President Hoover will deliver an address at the annual banquet March 19 in the Waldorf-Astoria Hotel. At this banquet Dr. William N. Lacey, California Institute of Technology, will be awarded the A.I.M.E. Lucas Medal for distinguished achievement in improving the technique and practice of finding and producing petroleum.

The Petroleum Division program, assembled by a committee under H. H. Kaveler, Phillips Petroleum Co., Bartlesville, Okla., will be given at the Pennsylvania Hotel, March 19-22. The division dinner March 20 will be addressed by William E. Wrather, director of the United States Geological Survey, and will mark the installation of officers for 1947. Chairman Howard C. Pyle, vice president, Bank of America, Los Angeles, and Vice Chairman John H. Murrell, DeGolyer & MacNaughton, Dallas, and Lloyd Elkins, Stanolind Oil & Gas Co., Tulsa, will succeed Herbert F. Beardmore, Barnsdall Oil Co., Tulsa, the incumbent chairman, and other officers who served through 1946.

Executive Committee Named

The new executive committee of the division will consist of Stuart E. Buckley, Humble Oil & Refining Co., Houston; John E. Sherborne, Union Oil Co. of California, Santa Fe Springs, Calif.; William V. Vietti, The Texas Co., Houston; William W. Porter II, consultant, Los Angeles; J. B. Umpleby, consultant, Dallas; and William B. Berwald, Ohio Oil Co., Findlay, Ohio, and the officers.

Technical sessions will be presided over by Charles B. Carpenter, Bureau of Mines, Dallas; Richard W. French, Jr., Continental Oil Co., Ponca City, Okla.; and John S. Bell, Humble Oil & Refining Co., Tyler, Tex.

In addition to numerous reports on world-wide petroleum development in 1946, the program includes the following technical and economic papers:

"Potentiometric Model Studies," B. D. Lee, The Texas Co., Houston; "Some Uses and Limitations of Model Studies in Cycling Patterns," D. L. Marshall, The Texas Co., New Orleans, and L. R. Oliver, The Texas Co., Houston; "Phase Behavior in the Methane-Ethene-n-Pentane System," William N. Lacey, G. W. Billman, and B. H. Sage, California Institute of Technology, Pasadena; "The Quantitative Valuation of Methods of Procedure in Water-Flood Production," Harry M. Ryder, consultant, Washington; "Advantages of Brine in Secondary Recovery of Petroleum by Water Flooding," Richard V. Hughes and Rudolph J. Pfister, Pennsylvania Grade Crude Oil Association, Bradford, Pa.

"A Meter for Measuring the Distribution of Gas Flow in Well Bores," F. Morgan and D. W. Reed, Gulf Research & Development Co., Pittsburgh, and L. L. Gray, Gulf Oil Corp., Tulsa; "Use of Well Flow Meter for Logging Relative Producing Ability of Individual Sand Members of Gas Wells," R. P. Vincent and R. M. Leibrock, Stanolind Oil & Gas Co., and C. W. Ziemer, Barnsdall Oil Co., Tulsa; "Radioactive Markers in Oil-Field Practice," H. G. Doll and H. F. Schwede, Schlumberger Well Surveying Corp., Houston; "A Reservoir Study of the West Edmond, Oklahoma, Hunton Pool," Max Littlefield, A. C. Godbold, and L. L. Gray, Gulf Oil Corp., Tulsa; "Significance of World Petroleum Production Trends," Warren L. Baker and L. J. Logan, The Oil Weekly, Houston.

"Competitive Fuel Prices," A. J. McIntosh, Socony-Vacuum Oil Co., Inc., New York; "Use of Oil Emulsion Mud in the Sivills Bend Field," W. H. Echols, Standard Oil Co. of Texas, Gainesville, Tex.; "Oil-Base Drilling Fluids," George Miller, Oil Base, Inc., Los Angeles; "Valuation of Reservoirs for Cycling," W. H. Justice, Tide Water Associated Oil Co., Houston; "The Calculated Effect of Pressure Maintenance on Oil Recovery," Robert L. Hoss, Tulsa; and "Corrosion in Gas-Condensate Wells Successfully Minimized With Ammonium Hydroxide," P. P. Spafford, Houston, and Paul L. Menaul, Tulsa, Stanolind Oil & Gas Co.

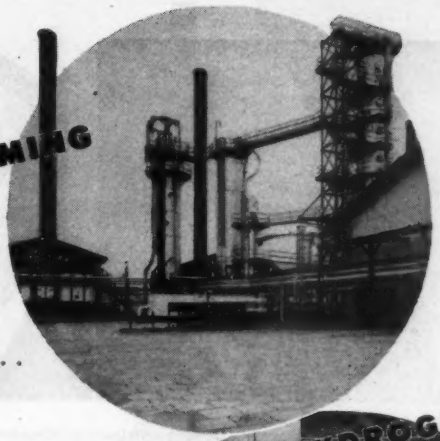
Texaco Holds Meeting Of Producing Committee

Officials of the producing department, The Texas Co., left Houston February 28 to attend the annual meeting of the producing committee of the company this week in New York.

L. E. Barrows, manager of the producing department, headed the party. Others from Houston were E. R. Filley, A. R. Wilson, J. C. Brooks, J. N. Troxwell, W. V. Vietti, V. L. Porter, L. A. Scholl, Jr., W. C. Kneale and E. P. Hayes.

They were to be joined by C. B. Williams of Fort Worth, R. L. Keyes of New Orleans, M. J. Heald of Tulsa, H. A. Stewart of Denver and J. T. Wood, Jr., of Los Angeles.

R. Ogarrio, vice president in charge of producing operations, is chairman of the producing committee. Barrows is vice chairman.



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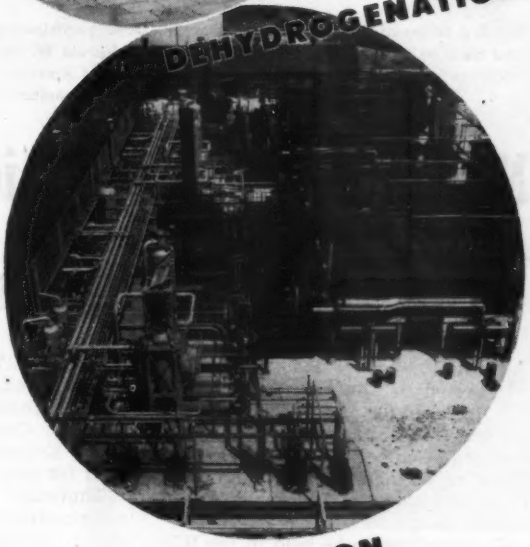

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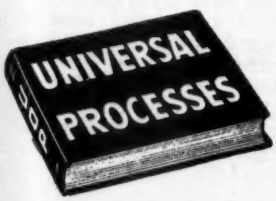
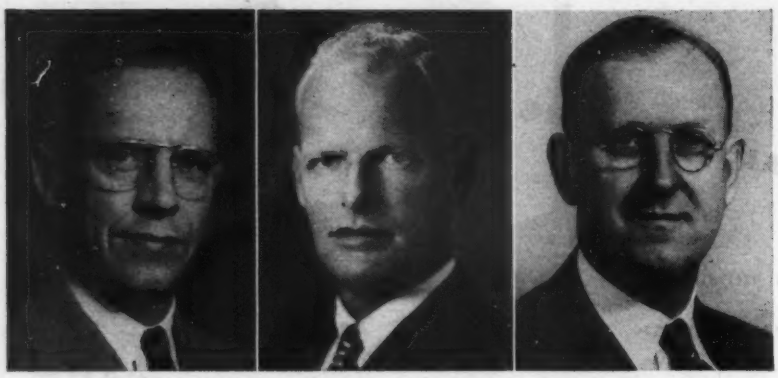




Heading a group of representatives of the three participating societies who planned the joint meeting in California are these three men: Harold W. Hoots, consulting geologist, general convention chairman; Howard C. Pyle, Bank of America, general vice chairman; and Robert W. Clark, Western Gulf Oil Co., technical program chairman

New Exploration Techniques Slated For Discussion in Los Angeles

MORE than 1,500 delegates are expected in Los Angeles March 24 for the opening of the joint meeting of the American Association of Petroleum Geologists, the Society of Economic Paleontologists and Mineralogists, and the Society of Exploration Geophysicists.

The meeting, to be held in the Biltmore Hotel, will include 4 days of technical and general sessions on geology, closing with a dinner dance March 27, and will be followed by a 3-day geological field trip to study structural and stratigraphic features of California oil fields.

Preconvention activities will open Sunday, March 23, with a meeting of the A.A.P.G. research committee, headed by Dr. Shepard Lowman, Houston, which will continue its work of organizing projects for future scientific study by research agencies.

Registration will open Sunday and continue through Monday. Separate meetings of the three participating organizations will be held Tuesday, Wednesday, and Thursday. Joint sessions are scheduled for Monday, Tuesday, and Wednesday.

The technical program of the A.A.P.G., designed to present and explore problems encountered by those engaged in petroleum exploration in lands adjacent to the Pacific Ocean, will start Monday evening with a discussion of sedimentation in the small, deep basins such as those found on the Pacific Coast.

This theme will be followed Tuesday afternoon in a series of papers on California. Wednesday's sessions will be devoted to discussions of the geology of lands bordering the Pacific Ocean. Talks on Japan, Sumatra, South China, New Zealand, the Philippine Islands, Alaska, British Columbia, Central America, Eastern Peru, Ecuador, and Chile are scheduled for this session.

Thursday will be devoted to domestic-oil-field papers and will include descriptions of a variety of fields in Texas, Louisiana, Florida, Oklahoma, New Mexico, the Rocky Mountain states, and California.

The S.E.G. technical sessions will feature approximately 50 papers on such relatively new instruments and methods as the airborne magnetometer, surveying with radar, and radioactivity prospecting apparatus. Other subjects will include geochemical methods by which gases emanating from and around oil deposits are captured and analyzed. The group will make field trips to the La Brea fossil pits and the Los Angeles Museum Monday and to the seismological laboratory of the California Institute of Technology, Pasadena, on Wednesday.

The S.E.P.M. will conduct three technical sessions during the meeting. The first, on Wednesday morning, will feature talks on California stratigraphy. The Wednesday afternoon session will consist of general talks on areas both abroad and in the United States, dealing with foraminifera and other micro-organisms.

Thursday afternoon's session will take up sedimentation and will consider environmental conditions of shales, sandstones, and conglomerates.

First open session of the meeting will be a symposium on Tertiary and Recent sedimentation, to be held Monday night. A second open session, to be held Wednesday night, will be a symposium on thrust faulting, a condition frequently encountered in Pacific regions.

The postconvention geological trip will start at 9 a.m. Friday, March 28, and will take the geologists to Aliso Canyon field, oil fields of the Santa Clara Valley, and Ventura Avenue field. Saturday morning the Santa Maria area will be studied, and in the afternoon the party will leave for Bakersfield via Cuyama Valley, past the San Andreas fault and Midway Sunset field. On Sunday, oil fields of the west side and central part of San Joaquin Valley will be seen.

A general outline of the program follows:

Sunday, March 23

A.A.P.G. research committee meeting.

Monday, March 24

Joint registration and committee meetings. Evening: Open session, Tertiary and Recent sedimentation, a symposium.

Tuesday, March 25

Morning.—Joint sessions: presidential addresses and awards, reviews.

Evening.—A.A.P.G. California petroliferous basins. S.E.G. business meeting and technical session.

Wednesday, March 26

Morning.—Joint session: Geology of foreign lands bordering Pacific. A.A.P.G. business meeting. S.E.P.M.: California stratigraphy.

Afternoon.—S.E.P.M.: general paleontology.

Night.—Open session: thrust-faulting symposium.

Thursday, March 27

A.A.P.G. geology and development papers, Mid-Continent, Gulf Coast, Rocky Mountains.

S.E.P.M. morning symposium: sedimentary lithology.

S.E.G. technical sessions.

Evening dinner dance.

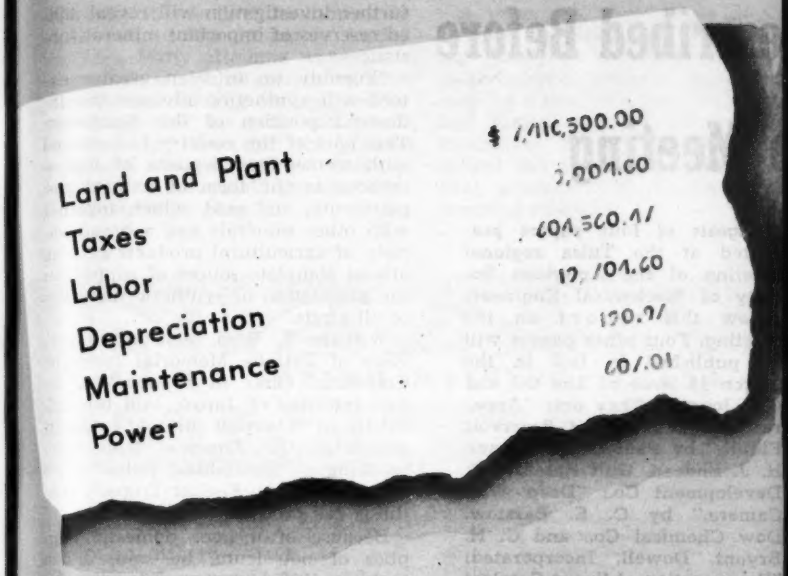
Committee chairmen representing the three societies who have laid the plans for the meeting are: General convention chairman, Harold W. Hoots, consulting geologist; general vice chairman, Howard C. Pyle, Bank of America; technical program, Robert W. Clark; Western Gulf Oil Co.; reception, C. R. McCollom, consulting geologist; field trips, John C. Hazzard, Union Oil Co.; hotels and housing, Vincent W. Vandiver, Seaboard Oil Corp.; entertainment, E. R. Atwill, Union Oil Co.

Transportation, H. J. Steiny, Tide Water Associated Oil Co.; registration, Vernon L. King, consulting geologist; S.E.P.M., Herschel Driver, Standard Oil Co. of California; finance, John R. McMillan, Fullerton Oil Co.; exhibits, W. P. Winham, Standard Oil Co. of California; S.E.G., Cecil H. Green, Geophysical Service, Inc., Eugene H. Vallat, Ohio Oil Co., and Henry Salvatori, Western Geophysical Co.; and publicity, Gordon R. Bell.

Panhandle to Purchase Two Texas Oil Firms

Panhandle Producing & Refining Co. last week contracted for the purchase of Red Bird Oil Corp. and Ceniza Oil & Gas Co., Texas concerns, through a proposed issue of approximately 500,000 shares of Panhandle common stock.

R. E. Muller, president of Panhandle, said the acquisition of the two companies would boost Panhandle's daily production to 4,300 bbl. of crude.



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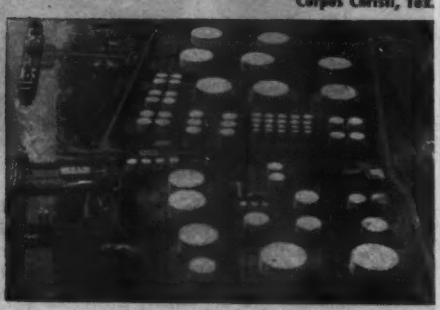
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Offshore Drilling Described Before A.S.M.E. Tulsa Meeting

IN an address on offshore drilling, R. G. Watts, Dallas, assistant chief engineer for Magnolia Petroleum Co., told a regional meeting of the American Society of Mechanical Engineers in Tulsa this week that the next few years "will see many more wells drilled in the Gulf waters and probably much farther out."

Speaking on the Magnolia well 10 miles offshore from the mouth of the Atchafalaya River, Watts said Magnolia now has four other wells in the planning stage to be drilled within 10 miles of the shore and another nearly 20 miles out. Magnolia, he said, now is in the process of constructing another drilling platform 29 miles offshore.

Watts said the first Magnolia well in the Gulf is now drilling directionally below 10,600 ft. from a whipstock set at 10,542 ft. after first being drilled to 12,874 ft. with no production. The Magnolia engineer spoke before a petroleum session and illustrated his paper with a 45-minute color motion picture.

Application of the technology which won the war to "win economic advantages" in the future will make the Southwest "a great center for the production of fuels and organic chemicals" even after the depletion of petroleum and natural-gas supplies, Harold G. Vagtborg, president of the Midwest Research Institute, Kansas City, Mo., declared in an address at the banquet at the meeting.

Digests of four papers presented at the Tulsa regional meeting of the American Society of Mechanical Engineers follow this report on the meeting. Four other papers will be published in full in the March 15 issue of The Oil and Gas Journal. They are: "Apparatus for Analysis of Reservoir Fluids," by Paul G. Exline and H. J. Endean, Gulf Research & Development Co.; "Deep - Well Camera," by O. E. Barstow, Dow Chemical Co., and C. H. Bryant, Dowell, Incorporated; "Regeneration of Spent Catalyst in Fluid Catalytic Cracking," by J. F. Snuggs, Standard Oil Co. (Ind.); and "Combustion of Coke Deposit on Synthetic-Bead Cracking Catalyst," by W. A. Hagerbaumer, Socony - Vacuum Oil Co., Inc.

"The Southwest still has an abundance and variety of minerals, and although other locations have in many instances yielded greater deposits, the depletion of these is giving greatly increased attention to the deposits of the Southwest," Vagtborg declared.

Appropriations for geological surveys, he said, "have been too meager in this region to really tell us what all the possibilities are, but the general nature of the geology of the area is such it would not be surprising that further investigation will reveal added reserves of important mineral substances.

"Possibly to an even greater extent will synthetics advance the industrial position of the Southwest. This part of the country is endowed with tremendous deposits of hydrocarbons in the form of natural gas, petroleum, and coal, which together with other minerals and a broad variety of agricultural products give an almost complete source of supply for the production of synthetic materials of all kinds."

William T. Reid, assistant supervisor of Battelle Memorial Institute, Columbus, Ohio, in a paper on the fuel industry of Japan, said the difficulty in obtaining suitable catalysts prevented the Japanese from ever reaching a "flourishing status" with operation of the Fischer-Tropsch synthesis gas process.

Because of meager domestic supplies of petroleum, he said, Japan early in 1937 began an intensive development program on the production of synthetic liquid fuels from coal, but it was not until after the start of the war that commercial plants were constructed. "Prior to and during the war, considerable research was conducted on the hydrogenation of coal by the Bergius process and production of liquid fuels by the Fischer-Tropsch synthesis process," he said. Operational difficulties, he added, prevented success of the Bergius proceess on a commercial scale.

"Shortages of lubricants near the end of the war," he declared, "forced mine operators to install small-scale, low-temperature carbonization plants to recover coal tar from high-ash waste coals. The coal tar obtained was used directly as a lubricant for mine-car wheels and for the pulleys of the cable-haulage systems in common use.

Among those at the American Society of Mechanical Engineers' regional meeting in Tulsa was the group shown here: Front row—J. Calvin Brown, Los Angeles, vice president, Region 7; N. E. Funk, Philadelphia, vice president, Region 3; A. K. Mumford, New York, vice president, Region 2; W. H. Carson, dean of the College of Engineering, University of Oklahoma, Norman; Alex D. Bailey, vice president, Commonwealth Edison Co., Chicago, past president; Eugene W. O'Brien, vice president, W. R. C. Smith Publishing Co. and managing director, Southern Power & Industry, Atlanta, Ga., president; H. M. Cooley, Bethlehem Steel Co., and president, Engineers Club of Tulsa; S. R. Beitler, professor of engineering, Ohio State University, Columbus, vice president, Region 5; and Lewis Helander, head of Department of Mechanical Engineering, Kansas State College, Manhattan, vice president, Region 8. Back row—W. Fred Stewart, Spartan Aircraft Co., Tulsa, chairman, Mid-Continent section; W. H. Stueve, chief industrial consultant, Oklahoma Gas & Electric Co., Oklahoma City; Carl A. Stevens, consulting engineer, Tulsa; Guy F. Williams, Dowell Incorporated, Tulsa; Dean E. Foster, materials coordinator, Bethlehem Supply Co., Tulsa; Ernest Hartford, New York, executive assistant secretary; Orval Lewis, project engineer, Jones & Laughlin Supply Co., Tulsa; C. E. Davies, New York, secretary; H. F. Brindel, Gulf Oil Corp., Tulsa; D. E. Fields, vice president, Tulsa Boiler & Machinery Co., Tulsa, past Mid-Continent chairman

However, it was low in lubricating value and useless in highly loaded bearings. Many attempts were made to produce semisolid greases by such procedures as adding bentonite or by processing the tar with gelatinous seaweeds and lime, but the greases so formed were of very poor quality compared to industrial lubricants having a petroleum base."

A paper on "Combustion of Coke Deposit on Synthetic Bead Cracking Catalyst," presented by W. A. Hagerbaumer, refinery design engineer for Socony-Vacuum Oil Co., Inc., and Russell Lee, of the company's Paulsboro, N. J., laboratories, discussed the stagewise combustion of coke deposits from flowing beds of cracking catalysts.

DIGESTS

A.S.M.E. SPRING MEETING, TULSA

Fabrication Notes on Corrosion Resistant Alloys

J. C. HOLMBERG, Alloy Welding & Manufacturing Co., Tulsa.

CORROSION-RESISTANT alloys cover a wide range of chemical compositions. There are available over 260 various alloys which are very broadly considered as stainless steels. In addition to all these are the various alloys based upon nickel and copper.

In each ferritic and the austenitic grades there are roughly 12 variants of analyses. There are also certain chemical modifications which are typical of various manufacturers melting procedures and operating conditions. However, the bulk of all sheet or plate fabrication is generally confined to six austenitic grades and three ferric grades.

Straight chromium grades (Types 410, 430, and 446) have excellent corrosion resistance to oxidizing agents and good heat-resisting properties. They also have the advantage of a lower cost per pound than the chrome-nickel austenitic alloys but with their advantages they have inherent characteristics that make them harder to fabricate. Any heating operation wherein they are heated above 1,500° F. has a tendency to cause severe grain growth and resultant embrittlement after cooling. For this reason they are rarely riveted, and a weld would be coarse grained and brittle if it were of the same material. For this reason many specifications recommend that they be welded with an austenitic electrode to provide a more ductible jointure. Of these three alloys the Type 430 which is a low-carbon iron with 15 to 16 per cent chromium is the most popular for pressure-vessel fabrication.

Austenitic Grades

In the austenitic grades there are three general classifications. For all practical purposes the rules for fabrication of these alloys are the same. All have about the same physical properties taken in the annealed condition; they have good welding properties, they are all hard to machine, and all will cold work to a marked degree.

In this classification of materials the Type 304 is the most widely used. This alloy which is an 0.08 per cent maximum carbon, 18 to 20 per cent chromium and 8 to 10 per cent nickel, is a well balanced alloy. However, in the presence of certain corrosive media it has a tendency to pit and is not too stable. For this reason this basic analysis has been modified by the addition of molybdenum, producing a composition much more stable, especially in the presence of chlorides and sulfites.

Unfortunately these alloys do exhibit one peculiar undesirable characteristic (generally termed carbide precipitation) when heated to a temperature of 1,100° to 1,500° F. Fortunately remedies for the cure of this condition exist by means of heat treatment whereby the precipitated carbides can be redissolved back into solution making a sound material.

To overcome, or at least alleviate, this condition was the reason for the development of the stabilized alloys. In these an addition of either titanium in the ratio of four times the carbon, or columbium at 10 times, is added to the metal during the melting process. Both of these have a very high affinity for carbon and hold it in solution preventing the formation of chromium carbide. Quite obviously this is a major advantage, but it carries with it the penalty of increased cost. Even so it is not unusual to find these elements added to a great number of various analysis such as chromium - nickel - molybdenum, and the high-alloy groups such as Types 309 and 310 where heat treatment is impossible or impracticable and when conditions warrant the increased cost.

Fatigue Tests of Welding Elbows and Comparable Double-Miter Bends

A. R. C. MARKL, chief research engineer, Tube Turns, Inc., Louisville, Ky.

(Author's Abstract)

IT has long been known that the increased flexibility of curved pipe, resulting from its ovalization under the influence of bending moments, is reflected in increased stresses which are customarily evaluated by applying intensification factors to the stresses evaluated by the common beam theory. No similar information has heretofore been published regarding miter joints.

On the basis of comparative full-scale fatigue tests, the present investigation shows that, for double-miter bends of given proportions, the stress intensifications (at the corners) are 20 per cent greater than for long-radius welding elbows when bending moments are applied tending to open or close the bend, and 70 per cent greater when bending is done sidewise, out of the plane of curvature. Expressed in terms of fatigue life under identical conditions of pipe-line expansion, this means that welding elbows will withstand 2½ times as many stress reversals in bending in the plane, and 14 times as many cycles in bending transverse to the plane of curvature, as compared with miter bends.

Indications were obtained also that internal pressure has no marked effect on the magnitude of the stress intensifications encountered. Stress relieving and grinding the welds, likewise, produces no significant change in the endurance strength.

Power Turbines for Natural Gas Expansion

STEPHEN BENCZE, assistant division engineer, Turbine division, Elliott Co., Jeanette, Pa.

NATURAL-GAS expansion turbines are driven by gas in the same way that steam drives steam turbines. They do not convert energy into useful mechanical energy in the same way that the combustion-type turbine does; instead the available energy in expanding the gas is converted. The gas undergoes only pressure and temperature changes.

Exhaust from the expansion-type turbine may be used for combustion or chemical reduction whereas the exhaust from the combustion-type machine is composed of combustion products. The turbine may be operated on natural, producer, casinghead, and other similar gases or on hot air. In general design the expansion turbine differs little from the steam turbine; casings, valves, bearings, and other basic components are the same.

Experience has shown that under favorable conditions sour gas can be used satisfactorily to operate machines constructed of standard materials such as stainless or monel governor valves, stainless buckets, and carbon-steel wheels and shafts. Performance data on single-impulse, stage-type turbines operated on natural gas and on steam, at the same inlet pressures and temperatures, speeds, and exhaust pressures show an approximate ratio of gas rate to equivalent steam rates as follows:

	Rate (hp. hr.) ratio			
Sp. gr. (air = 1)	1,000 r.p.m.	2,000 r.p.m.	3,000 r.p.m.	4,000 r.p.m.
60	1.20	1.24	1.27	1.30
70	1.28	1.34	1.40	1.46
80	1.35	1.45	1.54	1.63
90	1.43	1.56	1.68	1.81

Difference in available energy in the gas and steam is responsible mainly for the higher gas rates, it is believed. Viscosity and density differences in the gas and steam contribute also to rate differences.

When turbine-inlet gas pressures are such that exhaust temperatures drop below 40° F., it is advisable to preheat the inlet gas. Preheating may be made with a simple heating jacket arrangement which is placed around the inlet gas main, conventional heat exchangers, or by fired superheaters depending upon the degree of superheat needed.

The natural-gas expansion-type turbine is adaptable to generator, pump, fan, and similar services. Where desired, a unit may be installed for dual operation on either steam or gas.

Low Temperature Impact Properties of Some Cast Steels

H. D. CHURCHILL, professor of engineering mechanics, Case School of Applied Science, Cleveland, Ohio.

(Author's Abstract)

THIS paper presents the results of tests made on nine cast steels, S.A.E. 1015, 1030, 1040, 2330, 3130, X-4130, 4330, 4630, and NE 8230, with various heat treatments, from room temperature down to —185° F. Also included are the results of an investigation into the effect of six deoxidation methods on the impact strength at various temperatures of steel NE 8230.

For the steels studied, it was concluded that the method of deoxidation is responsible for variations in impact strength at room and low temperature. Further, that the best heat treatment is a liquid quench and temper, with a high tempering temperature, and that no one cast steel gives the best impact strength for all types of heat treatments at all testing temperatures.

Versatility IS "CATERPILLAR" DIESELS' MIDDLE NAME

THE many uses to which it can be put around an oil field enable a "Caterpillar" Diesel Tractor to turn in an extraordinary number of profit-earning hours in the course of a year. Here's an ingenious one:

Picture shows a well-servicing outfit mounted on a "Caterpillar" D4. It can be set up or knocked down in five minutes. The Hyster winch raises the telescoping derrick which, when transporting, folds back on a gantry above the tractor. Unit can pull 1500 feet of sucker rod in an hour; pull and re-run the same length of 2" tubing (about 8000 pounds filled) in two hours.

For possible helpful suggestions on keeping "Caterpillar" Diesel oil-field equipment busy—and for unexcelled service toward keeping it in tip-top working condition — see your "Caterpillar" dealer.

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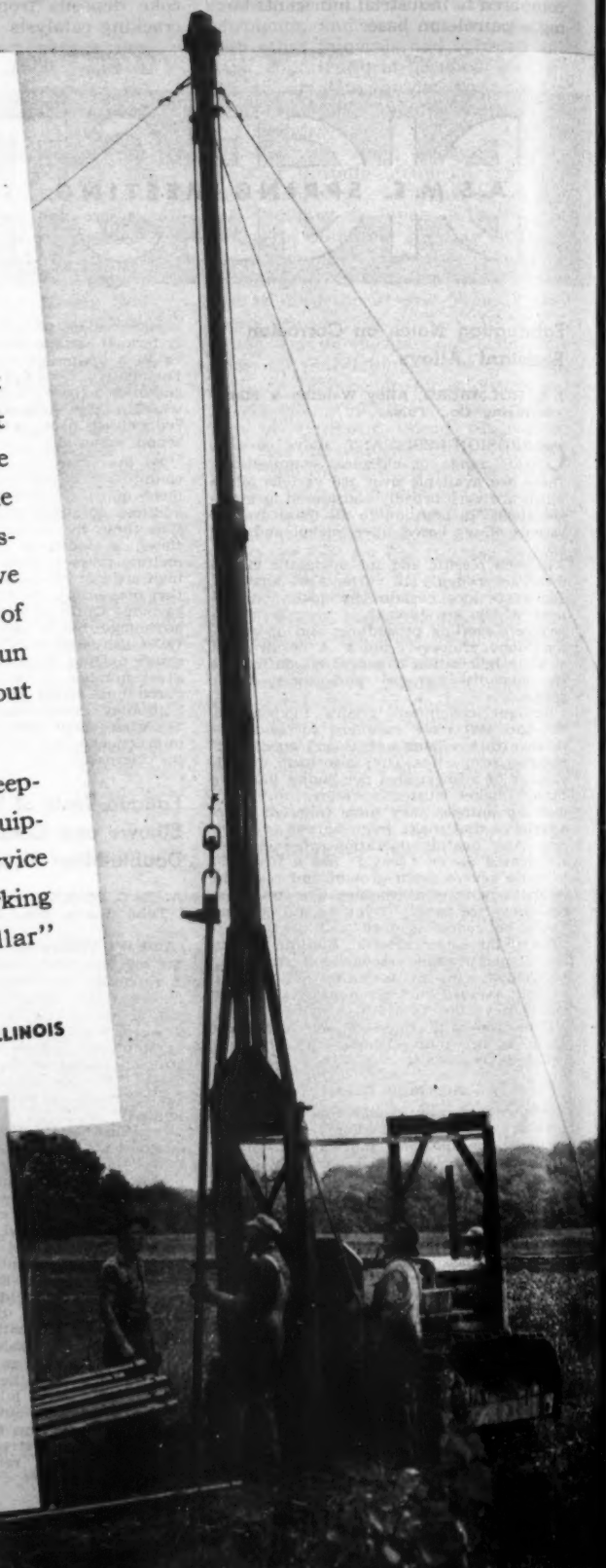


CATERPILLAR
REG. U.S. PAT. OFF.
DIESEL
ENGINES • TRACTORS
MOTOR GRADERS
EARTHMOVING EQUIPMENT

____this week

NATURAL GAS— Natural-gas industry asks united support of amendments to the Natural Gas Act introduced in both branches of Congress. . . . Legislation would restrict jurisdiction of FPC solely to interstate transmission of natural gas, prohibit regulation of end use, production, or gathering. . . .

PIPE LINE— Michigan-Wisconsin Pipe Line Co. awards contract to Ford, Bacon & Davis, Inc., for 26-in. line from Texas to Michigan and Wisconsin. . . . Ultimate cost of project estimated at more than $85,000,000. . . . ¶FPC denies motion to make Phillips Petroleum party to Michigan-Wisconsin case, thereby requiring Phillips to apply for certificate for facilities to sell gas to Michigan-Wisconsin. . . . ¶Northern Natural Gas files application with FPC proposing construction of additional lines and compressor capacity to meet increasing needs for gas in its market area. . . . Cost of the program placed at $24,500,000. . . .

REFINING—A.P.I. Refining Division schedules first postwar midyear meeting June 2-3 in St. Louis. . . . ¶W.P.R.A. sets up new industrial-relations division to keep members advised on current legislation and other matters. . . . ¶Ralph M. Parsons Co. named to make engineering and economic survey of remaining government-owned aviation-gasoline plants and facilities. . . .

INTERNATIONAL— Soviet Government make payment of about $500,000 to Socony-Vacuum and Royal Dutch-Shell interests against claims resulting from Russian operation of Austrian oil properties. . . . Partial settlement follows lengthy negotiations. . . . ¶Pemex buys four Mexican subsidiaries of Cities Service, which were among the few private companies remaining in Mexico after the 1938 expropriation. . . . ¶Sinclair Panama making preparations to spud in test on Columbus Island, Panama, some time in May. . . .

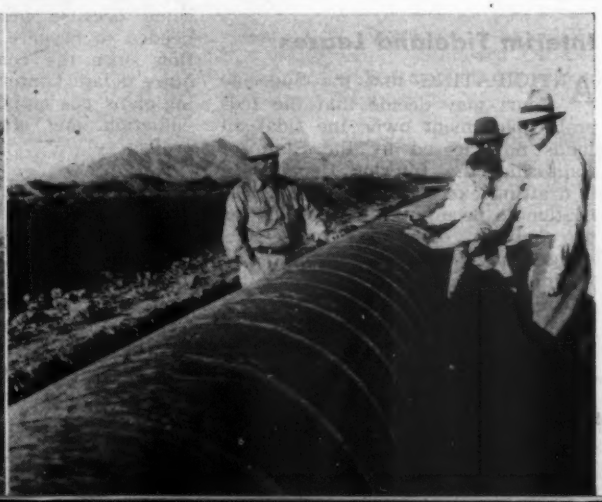
PRODUCTION— Louisiana March allowable set at 447,000 bbl. daily. . . . Kansas allowable unchanged at 270,000 bbl. daily. . . . Oklahoma output cut from 371,000 bbl. daily in February to 269,475 bbl. for March. . . . ¶Measures authorizing pooling of leases favorably reported by committees in the Texas Legislature. . . . Proposals closely followed by industry with some opposition from royalty owners and independents. . . .

MARKETS— Burning oils make general advance in Mid-Continent and Midwest areas. . . . Products markets continue extremely strong throughout most of the country. . . . Gasoline prices rise in East. . . . Sixteen-cent increase posted for most grades of Pennsylvania crude. . . .

ACQUISITIONS— Stanolind buys properties of three operators in Slaughter pool of West Texas. . . . Total of 121 wells and 5,000 net producing acres included in deal. . . . ¶Panhandle Producing & Refining contracts for the purchase of Red Bird Oil Corp. and Ceniza Oil & Gas Co.

EXPLORATION— Texas Co.'s new discovery in Matagorda Bay, Calhoun County, Texas, flows 192 bbl. of 27°-gravity oil. . . . Magnolia discovery, Halderman area, Jim Wells County, makes 98 bbl. of 47.8°-gravity oil. . . . East Alice area, Jim Wells County, Texas, has new, deeper gas pay. . . . ¶Magnolia test 10 miles off Louisiana shore, set whipstock 10,542 ft., now drilling directionally at 10,601 ft. after getting dry hole at 12,874 ft. . . . ¶Lindsay area, McClain County, Oklahoma, in spotlight. . . . Carlock & Ryan Bromide test flows 400 bbl. oil in 4 hours. . . .

The first section of 30-in. high-pressure gas-transmission pipe line ever constructed was lowered in February 15 near the west bank of the Colorado River on the route of the Texas-California line. The 214-mile California section of the project is being built by Southern California Gas Co. and Southern Counties Gas Co. of California with H. C. Price Co. of Bartlesville, Okla., and Los Angeles, as the contractor. Scene at left shows the lowering-in operations of the first section; the pipe is being lined up for a tie-in weld to an extension of pipe already placed under one of the many irrigation canals in the area of Blythe, Calif. The right photo shows 30-in. line welded and ready for lowering. In the picture are Bill Pitkin, chief inspector, and Al Shaw, assistant inspector, of the two California companies; Don Maxson, welding engineer, and Charles LeNoir, general superintendent of the H. C. Price Co. One crew is working westward from Blythe; the second crew of the Price company is scheduled to commence work near Beaumont, Calif., early in May and also will work westward to the terminus in Los Angeles



WATCHING WASHINGTON

(Continued from page 39)

investigation was started during the war when federal regulation of everything was quite the order of the day.

Now the industry has grabbed the ball and is running with it. FPC finds itself on the defensive—and before a Congress which is repealing laws and limiting regulatory agencies as fast as it can get around to them.

L.P.G. Tank Cars

TO clinch the decision that no more pressure tank cars will be taken away from the liquefied-petroleum-gas industry, the Office of Temporary Controls has ordered that the L.P.G. industry be permitted to purchase the 423 cars it is now leasing from the Army.

These are the cars which the Army has been trying to get back to use in its fertilizer program, but the official government policy now is that this program must be curtailed and the L.P.G. industry must keep its cars. So these cars are being declared surplus and turned over to the War Assets Administration for sale.

However, WAA will not be permitted to sell them to veterans, speculators, the chemical industry, or other general purchasers. OTC has directed that WAA sell the 423 pressure cars only to persons and in quantities as designated by the Office of Defense Transportation for L.P.G. service. While the cars will thus remain in L.P.G. service, the companies now leasing them may not be the ones permitted to purchase them, since sales will be apportioned on a formula based on the fleets of each owner at some previous date.

The sales price will be fixed by WAA and probably will be the current replacement cost less depreciation, which may add up to more than the Government paid for the cars in the first place. Since the rental on these cars has already returned virtually the original cost in some instances, the tank-car deal may turn out to be one of the Government's most profitable investments.

Interim Tideland Leases

ANTICIPATING that the Supreme Court may decide that the federal Government owns the tidal oil lands now leased by the State of California, the Interior Department is drafting executive orders and legislation to permit the present lessees to continue operating those submerged tracts now being produced.

Nothing final will be done, of course, until the Supreme Court decides, but the department is getting ready just in case.

The present view of the department is that if submerged lands are held to belong to the federal Government they will not be part of the public domain proper, and hence not subject to leasing under the Public Lands Leasing Act. Therefore the various parties who have filed applications with the department in past years for leasing permits to the tidelands have no standing. But immediately the present operators would be trespassers on government property. To avoid a chaotic situation the department plans to issue interim leases to these operators, presumably on the same terms as the present state leases, and then to submit to Congress the draft of legislation for future development—or conservation—of petroleum in all submerged lands.

Big Inch Right-of-Way

NOW that the Department of Justice has interposed no objection, the War Assets Administration has signed a formal letter of intent to sell the Big Inch system to Texas Eastern Transmission Corp.

However, it may be months before the sale can be finally consummated, since the Government first must perfect title to the entire right-of-way. This involves completing a great many individual condemnation suits for parcels of land scattered along the route from Texas to New Jersey. Under its emergency powers the Government took the land it needed and offered the owners what is considered a fair price. Where the owner did not accept the offer the matter went to the courts for determination of a fair price. It is not anticipated that any of these suits will be difficult to settle, but some of them may involve protracted delays.

In the meantime, Texas Eastern plans to negotiate with WAA an interim lease on substantially the same terms as Tennessee Gas & Transmission Co. now has, and then apply to the Federal Power Commission for a temporary certificate to continue to operate the lines on the T. G. & T. plan.

Only after Texas Eastern gets final title to the property will it apply to FPC for a permanent certificate, but the delay will not be entirely unwelcome because much time will be needed to prepare the FPC application since the commission will require detailed information on operating plans, gas supplies, markets, rates, valuation, and other phases of the project.

Hearings on Treaty Slated March 17 or 18

WASHINGTON.—Hearings on ratification of the Anglo-American petroleum treaty are expected to be held by the Senate committee on foreign relations March 17 or 18.

State Department officials are at work preparing data in support of the agreement but as yet there is no schedule of witnesses who will appear either for or against it.

Louisiana Allowable Increased 100 Bbl.

The upward trend of Louisiana's daily allowable continued to hold for March as an order signed last week by Conservation Commissioner Joseph L. McHugh set the March production at 447,000 bbl. daily, 100 bbl. above the February figure of 446,900 bbl. The new figure was more than 40,000 bbl. above that of March a year ago.

Kansas' daily allowable remained unchanged at 270,000 bbl. while Oklahoma's figure was cut to 269,475 bbl. daily from a February figure of 371,000. In New Mexico the regulatory body placed the March allowable at 112,000 bbl.

Shallow New Jersey Now Being Drilled

NEW YORK.—Drilling of a 2,500-ft. test well by Van Oil Co. on a farm owned by Martin Dolak in New Jersey's Hillsborough Township is now in progress. Hillsborough is located in the foothills of the Sourland Mountains.

Standard Oil Co. of New Jersey once looked over this general area but never conducted any tests.

Texas Legislature Studies Lease-Pooling Legislation

Bills to legalize pooling of oil leases for exploration, development and operation, have been reported favorably by committees of both houses of the Texas Legislature. Action on the floor, however, is expected to be delayed pending completion of many bills having priority over the unitization bills.

The two bills now being studied differ in that the measure proposed in the House contains a section stating that agreements entered into under the authority of the bill would not be construed as in violation of the antitrust laws. The Senate bill does not carry this provision.

In general, this proposed legislation is regarded favorably by oil and gas operators in Texas, since it will promote development and production of both oil and gas on a reservoir basis and will therefore contribute greatly to ultimate recovery of petroleum hydrocarbons. The bills are being opposed by various royalty associations and some independents, who fear such legislation will give the oil industry a "blank check to violate state antitrust laws."

Products Prices Climb to Higher Levels in Strong Market

PETROLEUM products were moving at fractionally higher price levels throughout much of the territory east of the Rockies early this week following general upturns in an extremely strong market.

Burning oils advanced ⅛ cent in the Mid-Continent and Midwestern area in what many suppliers considered a long-overdue market movement. In New York, Standard Oil Co. of New Jersey announced advances up to 3/10 cent in the posted terminal price for motor fuel and aviation gasoline and increases up to 2/10 cent in kerosene.

The following Group 3 tank-car prices appeared to be ruling for the bulk of material moving in the Mid-Continent and Midwest:

	Cents
Premium-grade gasoline	7¾ to 8
Regular-grade gasoline	7 to 7¼
Gasoline, 60 octane and below	6¼ to 6½
42-44 kerosene	5⅞ to 6
41-43 kerosene	5¾ to 5⅞
Range oil	5⅜ to 5⅝
No. 1 fuel oil	5¼ to 5⅜
No. 2 fuel oil	5 to 5¼
No. 3 fuel oil	4⅞ to 5
Zero gas oil	4¾ to 4⅞
Ordinary gas oil	4⅜ to 4½
Residual fuel oil	$1.39 to $1.45

The new postings for gasoline represented an advance of ⅛ cent on the highs of the quotations. Small quantities of motor fuel continued available at slightly higher figures, but the amount of this material was said to be extremely limited.

Refiners talked of a possible return to the 1-cent spread between regular and premium-grade gasoline prices. One informed market source pointed out this is more likely if the spread in octane number between the two grades increases to six points or more. Present octane differential is about five points with regular approximately 73.5.

The tank-car shortage continued to plague Midwestern suppliers. Some were refusing burning-oil orders, both because of lack of material and lack of cars. Some refineries, it was reported, are now cracking greater quantities of straight-run distillates in order to build up gasoline inventories for expected record consumption this summer. This contributes to tightening the burning-oil market.

Natural gasoline remained strong, despite the fact the product is now entering the season where a marked decline was generally experienced in prewar years. Prices this week were firm at 5 cents Group 3 and 4⅝ North Texas.

Speculation over the possibility of a crude price advance was heightened by the advance in products. A further rise in the Midwest and Mid-Continent gasoline market was held likely. One marketing official remarked, "the situation has all the earmarks of a general crude increase."

In announcing its gasoline and kerosene advances, Standard of New Jersey said the increases were made "to meet advances in the wholesale market at refineries." At other points, the company said, the added cost of transportation in such states which have authorized new tariffs will be included in the new tank-car and tank-wagon prices.

The major weak spot in the petroleum market picture was still light heating oils in New York. Prices for No. 2 showed further weakness last week when three suppliers reported reducing barge quotations 0.15 cent to 5.65 cents to meet "competitive conditions." This fifth successive reduction in No. 2 prices in 2 months was attributed to dumping of additional Gulf Coast cargoes in New York and shading of barge prices.

Reports of a tight market were received from Texas. Kerosene was reported up ⅛ cent in both North Texas and on the Gulf Coast. Kerosene on the Gulf Coast was quoted at 5¾ cents, and buyers were said to be scrambling for available supplies.

A.P.I. Marketing Meeting Scheduled for April 1-2

Petroleum marketers will gather at French Lick, Ind., April 1-2 for a national oil-marketing meeting sponsored by the general marketing committee of the American Petroleum Institute.

Speakers announced by P. E. Lakin, Shell Oil Co., Inc., New York, program chairman, include James A. Doolittle, vice president of Shell Union Oil Corp. and former Air Forces lieutenant general, who will discuss "Private Flying and Its Effects on Petroleum Marketing;" Dr. Claude Robinson, president of Opinion Research, who will speak on "The Oil Marketer and His Relations With the Public," and Charles Roberts, Stewart-Dougal and Associates, marketing-research consultants whose topic is "New Opportunities in the Petroleum Field for the Oil Marketer." B. L. Majewski, Deep Rock Oil Corp., Chicago, chairman of the general marketing committee, will preside.

DEATHS

Howard F. Faris, 57, Sayre, Okla., drilling contractor, died February 28 in a Shamrock, Tex., hospital of injuries sustained in an oil-field accident.

Robert T. Wilson, president of La Gloria Corp. and Reynosa Pipe Line Co., died recently.

Ben F. Brady, 54, drilling contractor in Shawnee, Okla., died recently.

O. C. Brewer, 49, warehouse supervisor for Humble Oil & Refining Co., died February 25 in a Houston hospital.

J. W. Koontz, 48, engineer with Oil Well Supply Co., died February 27 at his home in Tulsa.

A. Campbell, head of the land department of Tropical Oil Co., and **H. Coward,** head of the Tropical's materials department, have been reported as additional casualties of the crash of a Colombian Avianca airliner near Bogota February 15.

Eric C. Gyllensvard, former petroleum engineer and sales engineer with Standard Oil Co. (N.J.) foreign affiliates, was killed February 17 when struck by lightning while in San Paulo, Brazil, while on a business trip to South America. At the time of his death, Gyllensward was export and New York office manager of Farrel-Birmingham Co., Inc.

James Rendall Haden, 57, manager of the merchandising department of Richfield Oil Corp. of New York, died February 25 at his home in Rockville Center, L. I., N. Y.

Albert N. Eby, 43, geophysicist for Superior Oil Co., died February 22 at his home in Houston. Eby, born in Waco, had lived in Houston 14 years.

Walter Palmer Cutler, retired official of Atlantic Refining Co., died February 24 at his home in Melrose Park near Philadelphia.

Carroll W. Dressler, 40, organization counselor for Standard Oil Co. of California, died at his home in San Francisco, February 24.

Harold R. Shidel, 53, district manager of the Dresser manufacturing division of Dresser Industries, Inc., died February 28 at his home in Houston. He was a member of the Southern Gas Association, Houston Engineers Club, and the American Petroleum Institute.

Robert E. Garrett, 59, Tulsa geologist and independent operator, died March 4 near Bristow, Okla.

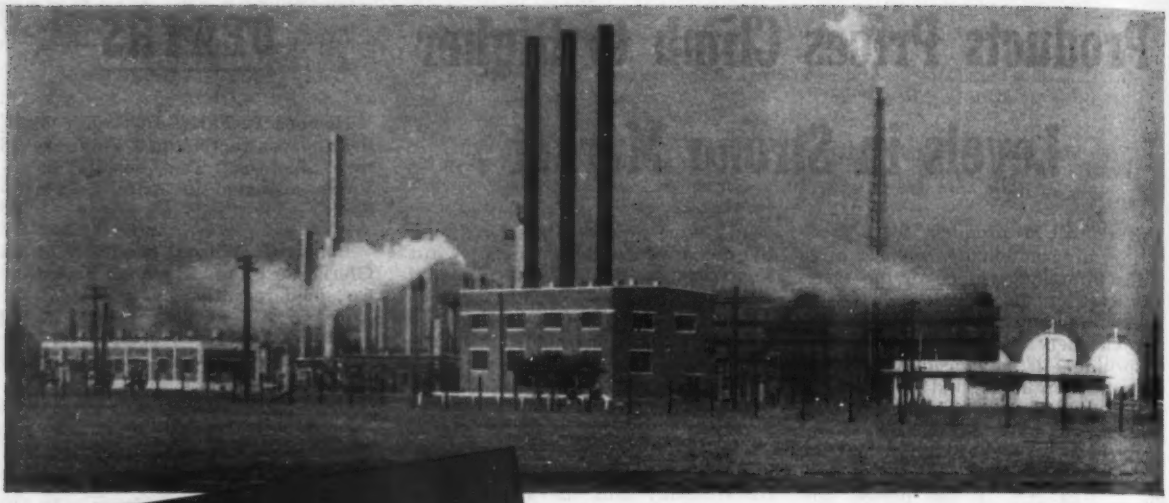


Fig. 1.—The 25,000,000 cu. ft. plant of McKamie Gas Cleaning Co. in Arkansas desulfurizes and processes the sourest gas commercially utilized today in large quantities. The 200-ft. flare shown in use in this photo was erected to burn the hydrogen sulfide before operations began in the adjacent sulfur-recovery plant. It is used now as a standby for disposing of the toxic gas when the sulfur plant is off stream

Sulfur from Sour Gas . . . . an added income

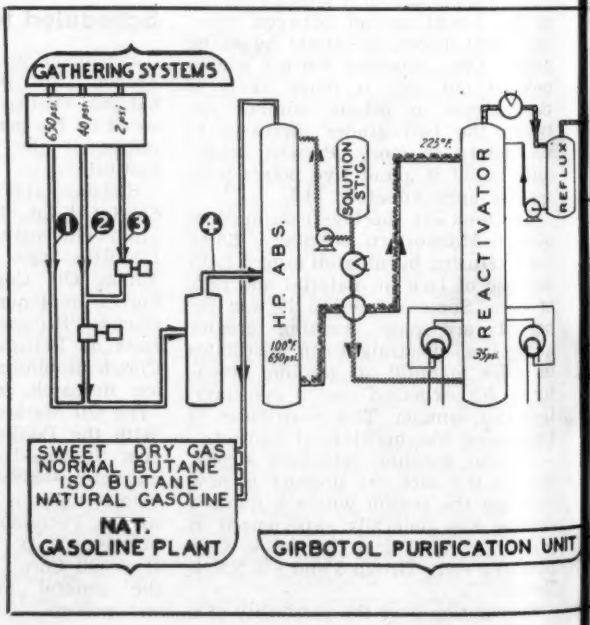
by George Weber

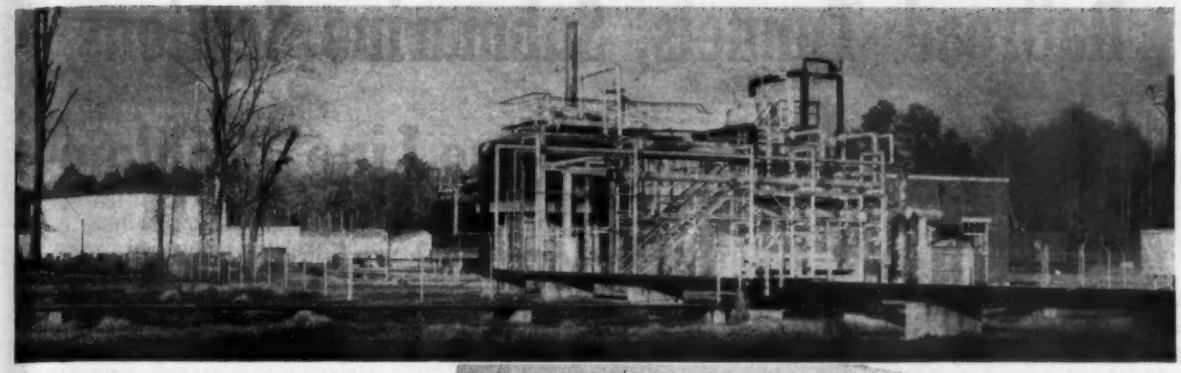
A SUCCESSFUL 3-year record of sweetening extremely sour gas and recovering byproduct sulfur in South Arkansas has proved the operation both practical and profitable. To date, over 75,000 tons of pure sulfur valued at nearly $1,250,000 have been recovered from the McKamie and Dorcheat-Macedonia fields. This is conservation in its highest form, for raw gas which amounted to a hazardous liability a few years ago now yields sweet pipe-line gas, natural gasoline, butanes, and sulfur with total current values totaling over 10 cents per M.c.f.

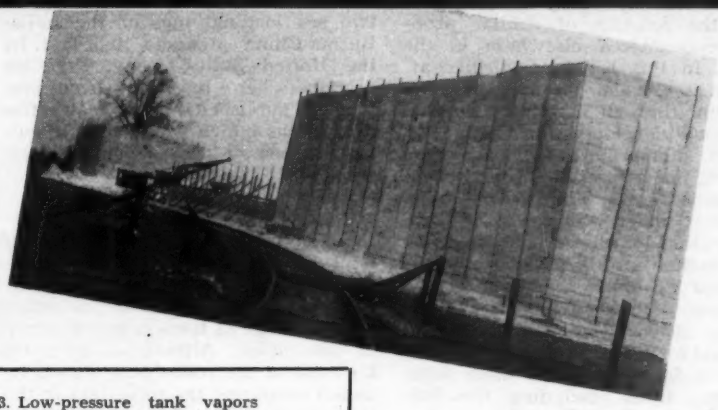
At McKamie, sulfur content of the gas is so high that its value equals nearly one-third of the total value of products obtained from raw gas, and the percentage royalty which the sulfur affords operators supports an important share of operating cost of gathering and processing the production. Although other fields with less sour gas will show relatively less income from sulfur, the experience gained in Arkansas indicates that sulfur recovery should prove feasible in many other plants sweetening and processing gas containing hydrogen sulfide.

History of Development

Arkansas' history of sour-gas production and utilization is well known. Development of extensive new reserves in the Smackover lime formation in the years immediately preceding the war was attended by a mounting production of objectionable sour gas. Pro-







duced with oil and condensate, it had no market. Its high content of hydrogen sulfide made it extremely toxic and even flaring it in the field constituted a hazard from poisonous sulfur dioxide fumes.

In 1941 the Arkansas Oil and Gas Commission, producers, natural-gasoline-plant operators, and service and chemical companies undertook a cooperative study to determine the possibilities of utilizing such gas. The results are evident in the present-day absence of waste and the added income from a number of gas products.

In 1941, Lion Oil Co. completed a treating plant in Magnolia field, employing the Girbotol process successfully to sweeten 15,000,000 cu. ft. daily of gas containing 1,500 grains of H_2S per 100 cu. ft. This was followed by a 60,000,000-cu. ft. plant of similar design treating 1,990-grain gas from Dorcheat-Macedonia for Arkansas Fuel Oil Co.

(Continued on page 84)

1. High-pressure gas stream
2. Intermediate-pressure gas stream
3. Low-pressure tank vapors
4. Combined stream

	1	2	3	4
ted volume, M.M.c.f. per day	22.0	2.3	1.0	25.3
mposition, mol per cent:				
Methane	66.15	89.11	2.90	63.87
Ethane	6.43	14.29	9.90	7.05
Propane	2.37	8.91	20.44	2.97
Isobutane	.56	2.24	10.30	.72
n-Butane	.66	2.62	15.65	.85
i-Pentane	.23	.77	7.53	.27
n-Pentane	.13	.42	4.06	.14
Hexanes	.11	.37	3.42	.11
Heptanes plus	.06	.07	3.75	.05
Nitrogen	12.00	7.09	.53	11.64
Carbon dioxide	4.50	4.31	.57	4.48
Hydrogen sulfide	6.80	19.80	20.95	7.84

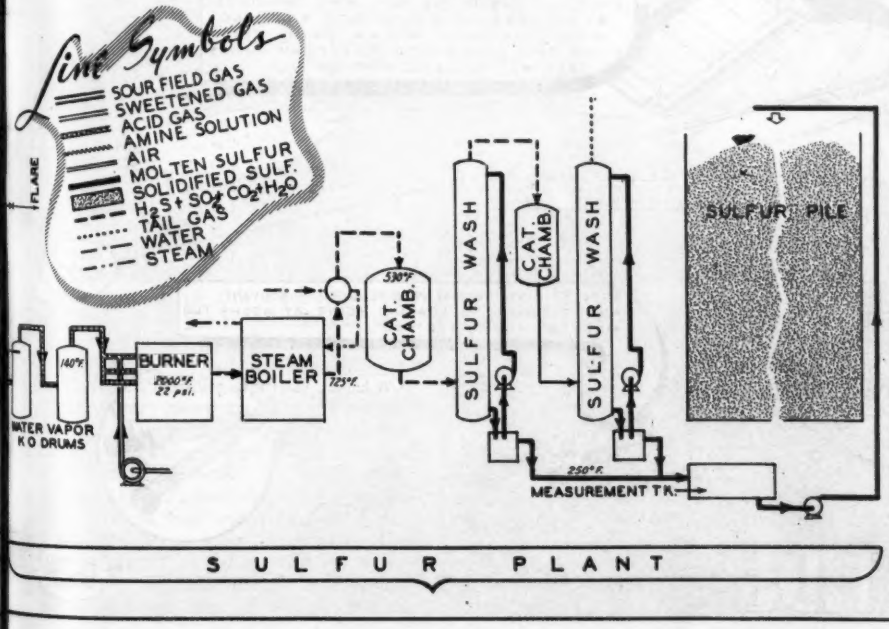


Fig. 2.—(Top of page) The first commercial plant for recovering elemental sulfur from sour gas in this country is operated at McKamie by Southern Acid & Sulphur Co. The sulfur piles are visible in the distance to the left of the plant

Fig. 3—(Center) Sulfur recovered from McKamie gas is solidified in large blocks adjacent to a railroad spur line at McKamie. Average plant production ranges from 60 to 65 tons of sulfur per day.

Fig. 4—(Left) Simplified flow chart of gas purification and sulfur recovery by McKamie Gas Cleaning Co. and Southern Acid & Sulphur Co.

Railroad Tunnels, Submarine Sections, Climate Pose Rugged Pipe-Line Problems

by Paul Reed

IN pipe-line construction in the Far East, certain procedures are significant to the industry in connection with the solution of similar problems encountered elsewhere in the world. In this article particular attention is given to measures for laying a line through 32 railroad tunnels, a method developed for laying two 8,000-ft. submarine lines to a marine mooring buoy, the relation of welded to coupled lines, and the handling of labor under tropical conditions. Information has been furnished by J. C. Britton, president, Britton Construction Co., Fort Worth, who was in charge of construction of approximately 1,650 miles of 4, 6, and 10-in. pipe laid for the project, starting from Budg Budg which is 18 miles from Calcutta, India, including the 700-mile Budg Budg-Tunsuki section with 24 pump stations at 29-mile intervals, the 560-mile Budg Budg-Kalukooda section with 22 stations at 25-mile intervals, the Chilligong-Tunsuki line as well as laterals and two sea loading lines of the India-Burma-China products line laid by the United States Army. Practices described here have not been previously published; these may offer suggestions which would lead to cutting the cost of some expensive operations.

Laying Through Tunnels

For laying 6-in. through the mountains of the Chilligong-Tunsuki section it was decided to follow the route of a narrow-gage tea railroad which went through 32 tunnels in a distance of 555 miles. Although the joints for most of the route were joined by bolted couplings, the pipe (laid in the tunnels) was all welded to safeguard against leakage which might cause a fire.

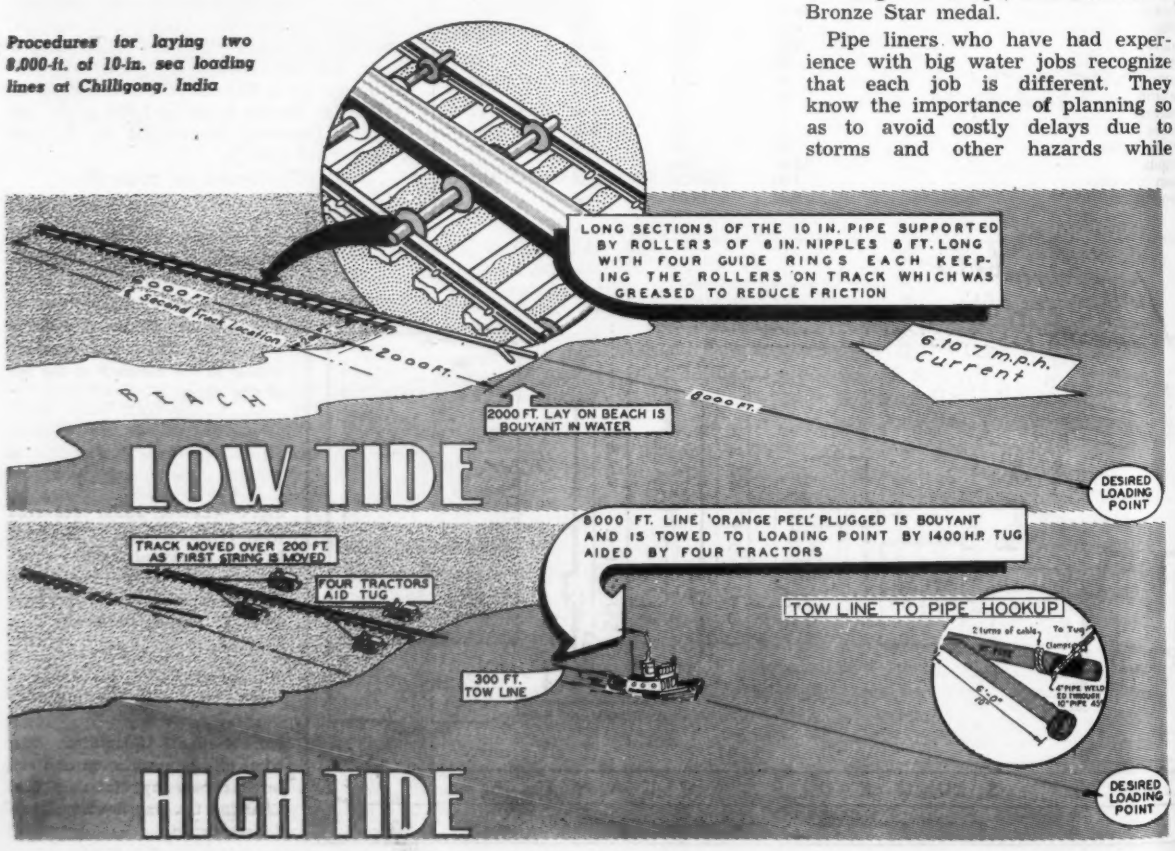
Welding was handled by stringing pipe between the railroad tracks in convenient locations in open country. Joints were welded in 1,500-2,000-ft. sections. One of these sections would be tied so that it swung under a train of cars which transported it to the part of the tunnel where it was to be installed. After the pipe was dropped and the train ran off, the section was rolled to one side of the tracks and welded to the remainder of the line. A train was assigned for living quarters for each gang engaged in these operations.

Sea Loading Lines

One of the most difficult undertakings of the project was the laying of two 8,000-ft., 10-in. submarine lines at Chilligong, India, in the Bay of Bengal. For the successful accomplishment of this particular project, Britton, then a lieutenant colonel in the Engineer Corps, was awarded a Bronze Star medal.

Pipe liners who have had experience with big water jobs recognize that each job is different. They know the importance of planning so as to avoid costly delays due to storms and other hazards while

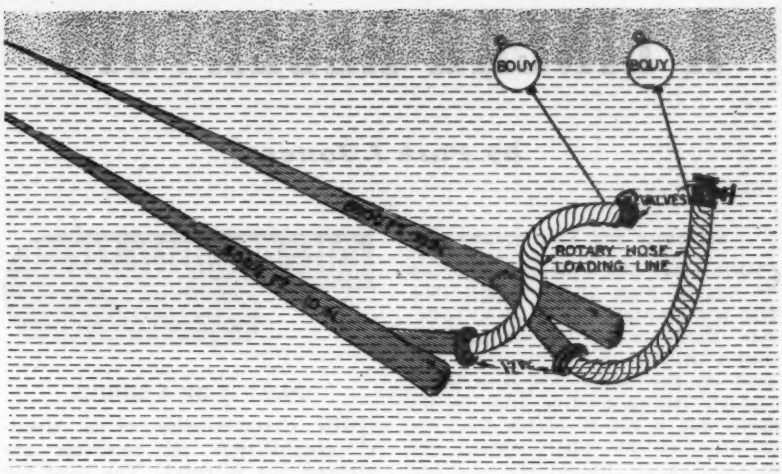
Procedures for laying two 8,000-ft. of 10-in. sea loading lines at Chilligong, India


LONG SECTIONS OF THE 10 IN. PIPE SUPPORTED BY ROLLERS OF 6 IN. NIPPLES 6 FT. LONG WITH FOUR GUIDE RINGS EACH KEEPING THE ROLLERS ON TRACK WHICH WAS GREASED TO REDUCE FRICTION
8000 ft. & Second Track Location
2000 ft.
6 to 7 m.p.h. Current
BEACH
2000 FT. LAY ON BEACH IS BOUYANT IN WATER
8000 FT.
LOW TIDE
DESIRED LOADING POINT
8000 FT. LINE 'ORANGE PEEL' PLUGGED IS BOUYANT AND IS TOWED TO LOADING POINT BY 1400 H.P. TUG AIDED BY FOUR TRACTORS
TRACK MOVED OVER 200 FT. AS FIRST STRING IS MOVED
FOUR TRACTORS AID TUG
TOW LINE TO PIPE HOOKUP
2 turns of cable
To Tug
Clamp
6" PIPE WELD TO THROUGH 10" PIPE 45°
300 FT. TOW LINE
HIGH TIDE
DESIRED LOADING POINT

barges and similar craft swing at anchor in a swift current and serious accidents occur which result in broken pipe. Furthermore, expensive experience with pontoons on Lake Pontchartrain and at other points has amply demonstrated that pontoons are impractical even under favorable conditions.

The solution of the main problem of the Chilligong line was unique in the manner in which it fully exploited the peculiarities of the local conditions and at the same time developed methods which would have a broad application elsewhere on other projects.

The Chilligong submarine lines had to be laid to a mooring buoy for tankers where water was 42 ft. deep at a distance of 8,000 ft. from shore.



Above: Installation of rotary hose loading lines on two 10-in. pipe lines

Left: Handling pipe in early attempts to lay sea loading lines with the use of capstan on the bow of craft available locally in India

Below: Laying gasoline pipe line alongside railroad tracks in India

which prevented the pipe from slipping off the track while the other two held the pipe on the middle of the roller.

The general procedure followed was to first weld a 2,000-ft. section on the tracks which was bullheaded with orange-peel welding and pulled by four tractors at ebb tide in a spring tide period so that it lay across the 2,000 ft. of beach then laid bare. A 6,000-ft. section was made up on the tracks; this section was welded to the 2,000-ft. section already lying across the beach, thus making a complete 8,000-ft. section. These sections were roll welded on dollies in units of nine-joint sections.

The 8,000-ft. section, at this stage of the procedure, was now situated with two important advantages: (a) 2,000 ft. of the pipe was buoyant in the water so that less power would be required to move the entire 8,000-ft. section; (b) at high tide of a spring tide period, the seaward end of the pipe was in water of sufficient depth to allow a tug boat to approach close enough to use a tow line only 300 ft. long. A reasonably short tow line is

(Continued on page 88)

Currents ran at the unusually high rate of 6 to 7 miles per hour. Tides rose and fell 9 to 17½ ft. Every 15 days extreme low tide at the time of a "spring" tide period would lay bare the beach for a great width of 2,000 ft.

Recognition of the advantage offered by this phenomenon was important for solving the problem of laying the submarine lines in the most effective manner.

On an easy slope up from the beach, railroad tracks borrowed from the British Engineer Corps, were laid for a distance of 6,000 ft.; rails were placed 5½ ft. apart. Across the rails, rollers were laid consisting of 6 ft., 6-in. nipples which supported the long sections of 10-in. Guides were furnished by installing four Dresser coupling rings on each roller, two of

A LINEAR RESERVOIR

*by Park J. Jones**

OIL PRODUCTION *by water*

PART 16 OF A SERIES

THE characteristics of a stratigraphic-type oil reservoir are mapped out in detail. The need for so much detail mapping will become evident from Parts 17 and 18 in which the reservoir will be considered as one and three producing units respectively.

Structure and Stratigraphy

CONSIDER the reservoir mapped out in Figs. 16-1 through 16-4. This is a stratigraphic-type' oil reservoir. Contours on top of pay are shown in Fig. 16-1. The productive limit on the south side is a water contact. The productive limit on the north side is 200 ft. higher than the elevation of the water contact. The east and west ends of the reservoir are limited by impermeable nonpay. The trap is called the L-1 reservoir. The variation in the length of strike with structural position is nominal. So the trap is classified as a linear reservoir.

Contours on bottom of the L-1 reservoir are shown in Fig. 16-2. The productive limits on the east, west, and north sides coincide with those in Fig. 16-1. The vertical lines A-A', B-B' and C-C' are traces of the sections in Fig. 16-3.

The pay-thickness contours are given in Fig. 16-4. The productive area enclosed by the zero contour is 7,054 acres. The average pay thickness for this area is 27 ft. The L-1 reservoir contains 190,460 acre-feet of pay.

Distribution of Pay

In order to estimate the distribution of productive area, pay thickness, and acre-feet of pay, horizontal planes are passed through reservoirs

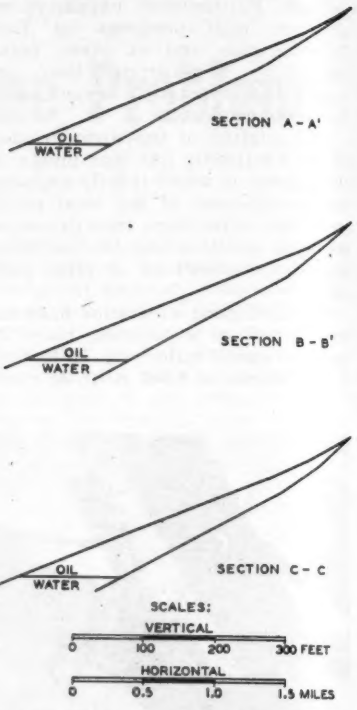


Fig 16-3—Vertical sections A, B, and C for L-1 reservoir

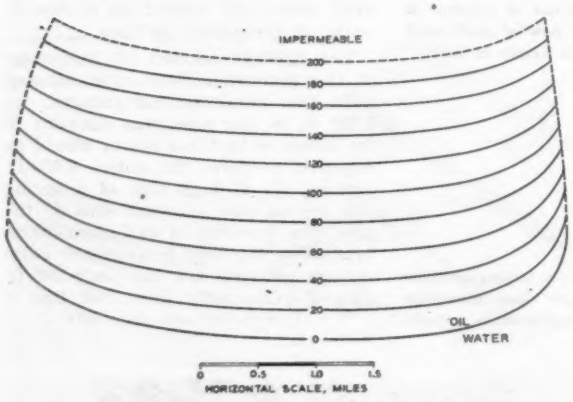


Fig. 16-1—Contours on top of L-1 reservoir

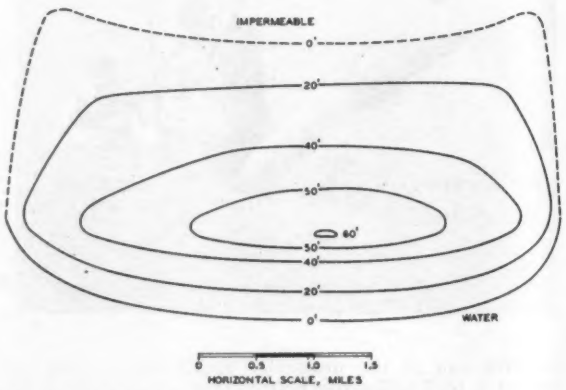


Fig. 16-4—Pay thickness for L-1 reservoir

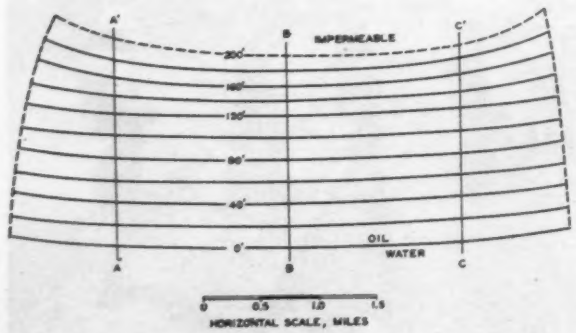


Fig. 16-2—Contours on bottom of L-1 reservoir and traces of sections in Fig. 16-3

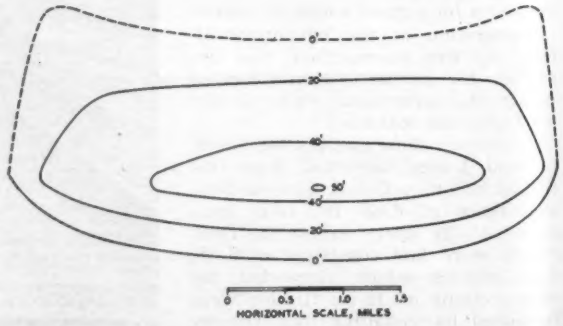


Fig. 16-5—Pay thickness above the 40-ft. level in L-1 reservoir

*Production consultant, Houston.

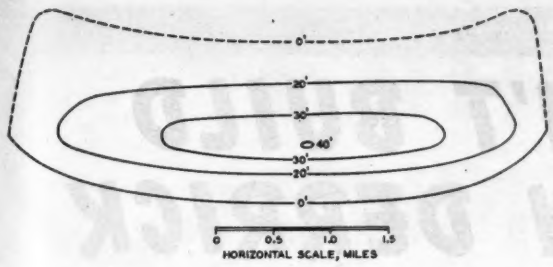


Fig. 16-6—Pay thickness above the 80-ft. level in L-1 reservoir

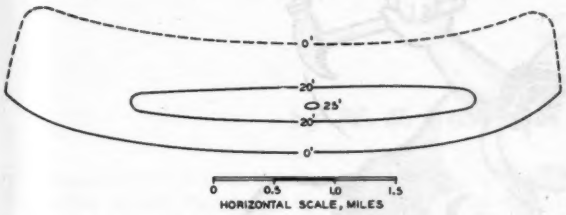


Fig. 16-7—Pay thickness above the 120-ft. level in L-1 reservoir

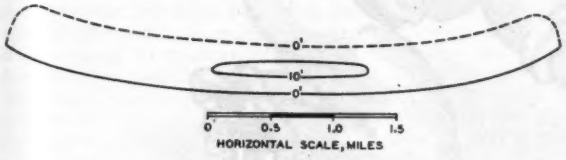


Fig. 16-8—Pay thickness above the 160-ft. level in L-1 reservoir

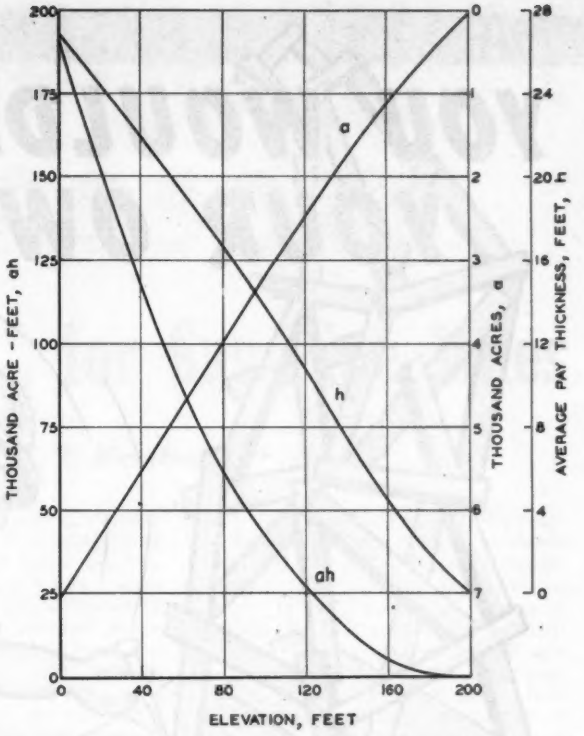


Fig. 16-9—Productive area (a), average pay thickness h, and acre-feet of pay ah vs. elevation in L-1 reservoir

at various levels. Fig. 16-5 shows the pay thickness above the 40-ft. level in the L-1 reservoir. The productive area enclosed by the zero contour is 5,517 acres. The average pay thickness of this area is 21.5 ft. There are 118,600 acre-feet of pay above the 40-ft. level.

TABLE 16-1 DISTRIBUTION OF PAY IN THE L-1 RESERVOIR

Elev., feet	Productive area, acres	Avg. pay thickness, feet	Acre-feet
160	1,093	4.6	5,030
120	2,502	10.8	27,020
80	3,970	16.8	66,700
40	5,517	21.5	118,620
.....	7,054	27.0	190,460
Symbol	a	h	ah

Figs. 16-6 through 16-8 show the distribution of pay above the 80, 120, and 160-ft. levels respectively. The data in Figs. 16-4 through 16-8 are itemized in Table 16-1 and illustrated graphically in Fig. 16-9. Productive area, average pay thickness and acre-feet of pay are plotted against elevation in the L-1 reservoir.

Acres of Oil-Water Interface

The area of the oil-water interface in the L-1 reservoir decreases in the updip direction. The data in Fig. 16-10 show the area and shape of the interface at the zero, 40, 80, 120, and 160-ft. elevations.

The areas shown in Fig. 16-10 are plotted against distance in Fig. 16-11. The distance is along the top of pay in a section through the middle of the L-1 reservoir. Distances are measured from the water contact, that is, updip from the zero contour of Fig. 16-1.

The A curve of Fig. 16-11 is used

(Continued on page 94)

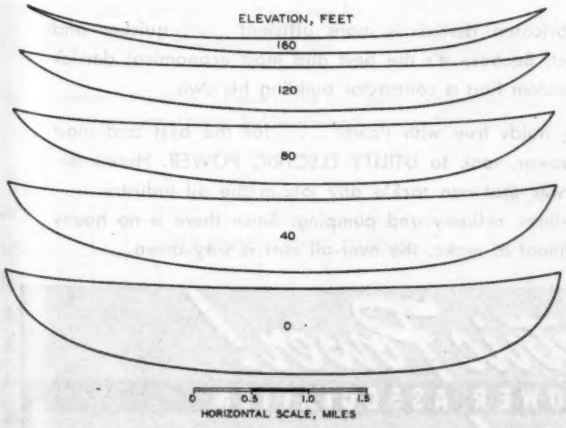


Fig. 16-10—Area of oil-water interface vs. elevation of horizontal sections in L-1 reservoir

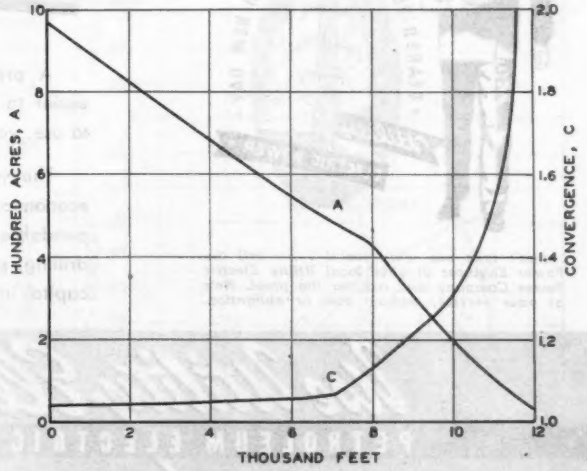


Fig. 16-11—Acres of oil-water interface A and convergence of reservoir C vs. distance along top of pay in L-1 reservoir

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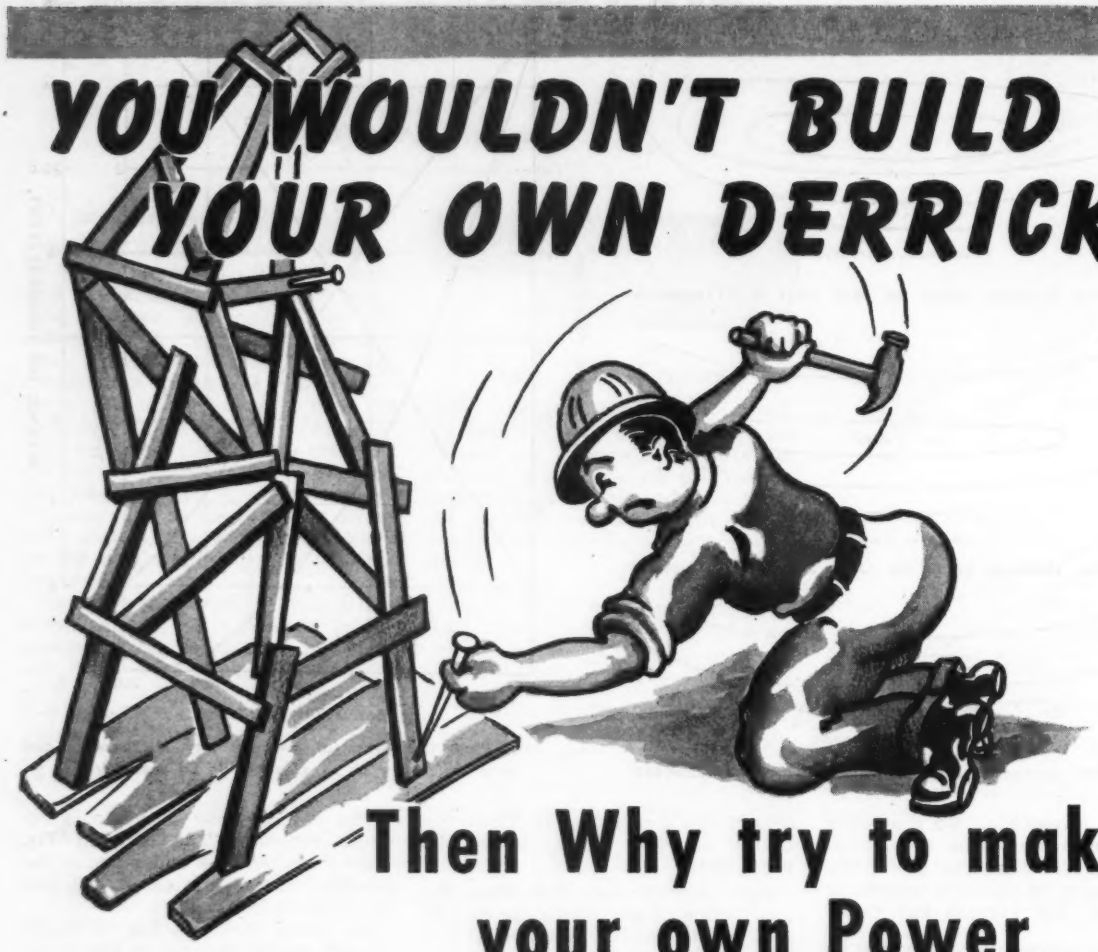

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CENTRIFUGAL COMPRESSORS ... for Gas Pipe Lines

by M. C. Shaw* and E. T. Neubauer*

THE application of centrifugal compressors to the transfer of natural gas, from the producing fields to the points of distribution, for industrial and domestic purposes has been frequently discussed. It is the purpose of this paper to present, objectively, some of the merits and demerits of centrifugal machines for this service and not to emphasize any particular make or type of machine.

The transportation of natural gas through pipe lines presents two widely different requirements, the first being the compressor installation at the producing field where the gas is compressed from the rock pressure of the field and/or that of the gathering pipe-line system to the line pressure. This operation usually involves a considerable increase in pressure, or in other terms, the compressors are required to operate at a high pressure ratio. The second phase is the propulsion of the gas through the pipe line by means of compressors more or less uniformly spaced along the pipe line. These compressors are required, in usual practice, to produce a much smaller pressure rise than those in the first category.

*Allis-Chalmers Manufacturing Co., Milwaukee. A paper presented at the annual meeting of the Petroleum Electric Power Association at Tulsa, December 3-4, 1946.

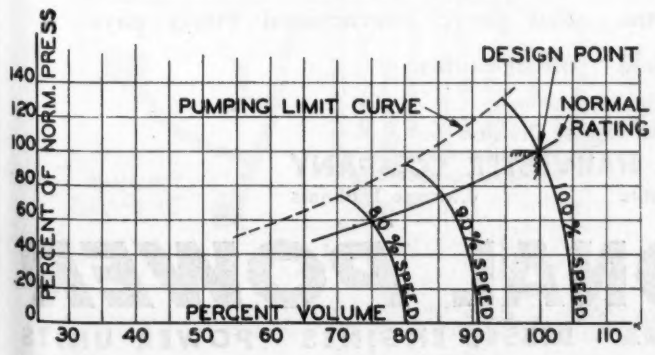
Now, by their very nature, centrifugal compressors are best adapted to handle comparatively large gas volumes and moderate pressure ratios. They can, however, be connected in series to produce the pressure ratios needed for the producing field stations, for example, to compress from 150 to 200 psi. to 800 or 900 psi., a pressure ratio of 5.5 to 4.5. Their adaptability for large volumes means that one compressor of relatively small physical dimensions could handle the entire capacity of a very large line. The same thing applies to booster units distributed along the line. A single compressor unit could easily handle 265 million standard cubic feet per day, boosting from perhaps 600 to 900 psi., a pressure ratio of about 1.5 to 1.

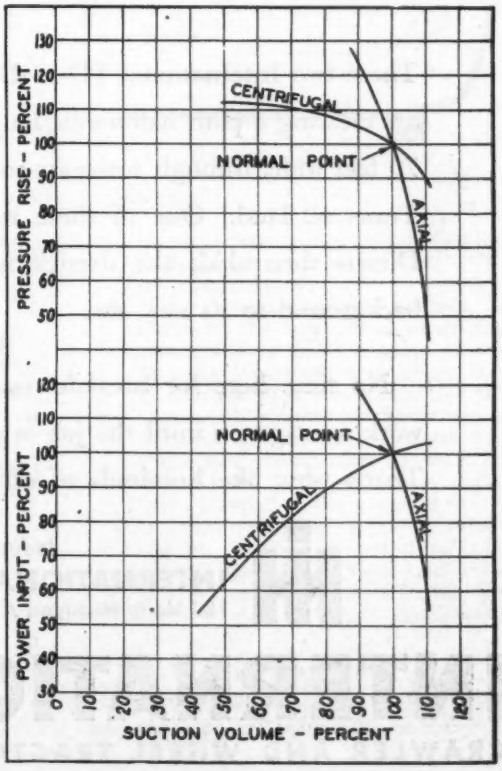
Economic and practical operating experience would undoubtedly dictate provision of spare units or subdivision of units.

Centrifugal compressors of the sizes adaptable for pipe-line service may be driven by electric motors but in commercial practice would usually require operation at speeds higher than 3,600 r.p.m. and therefore a speed-increasing gear would be required to obtain the most efficient performance. However, due to the large horsepowers to be transmitted, the gear problem for this application is difficult and should be avoided. Where electric drive is desired for other reasons it is possible to install a four or five-stage machine operating at 3,600 r.p.m. for ratios of compression of about 1.25 to 1. (See Fig. 4.)

Considerable interest has been shown in the possible application of the axial compressor to this service in order to capitalize on the inherently high efficiency of this type machine. The axial compressor is generally best suited for applications re-

Fig. 1—(Below) Pressure-volume curve for axial compressor. Fig. 2—(Right) Performance curves for centrifugal and axial compressors





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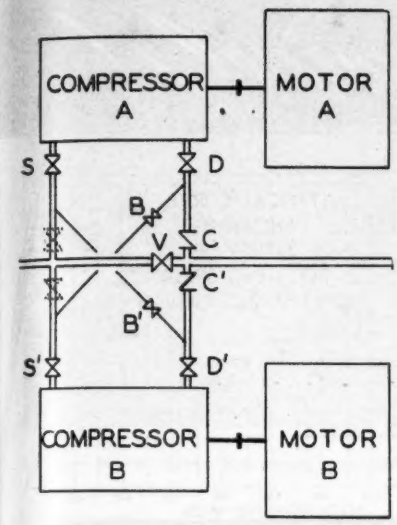

Fig. 3—Hookup for operating units in parallel

quiring large volumes of gas at a relatively constant rate of flow. The actual capacity, for a gas pipe line, could be controlled by speed control of the compressor or by dropping the line pressure thus decreasing the line capacity without change in gas volume through the compressor.

The high inherent efficiency of the axial compressor permits the use of many stages and correspondingly high ratios of compression. The volume under discussion in this paper would require a compressor of small physical dimensions operating at a very high rotative speed. If a machine of this design were to be driven by an electric motor operating at 3,600 r.p.m. it would require a gear unit operating far above present commercial gear ratings. Therefore the use of an axial compressor would require a high-speed prime mover which would operate at compressor speed with a direct-connected shaft.

For the gas-pipe-line application an axial compressor may be designed to operate at 3,600 r.p.m. and direct connected to a 3,600 r.p.m. electric motor but it would not have the most favorable dimensions. The ratio of blade length to cylinder diameter would be such as to sacrifice efficiency.

Centrifugal compressors are essentially durable machines and can be operated for extended periods without shutdown, only requiring positive lubrication of bearings and shaft seals and, therefore, completely automatic substations should be entirely feasible.

Within certain limits they are self-regulating, that is, the capacity of a machine driven at constant speed may vary according to the demand on the system. If the variation in demand exceeds the limits above mentioned, other means are available to regulate the flow of gas automatically. These means will be discussed briefly later.

The operation of a centrifugal compressor is very similar basically to a centrifugal pump — the compression and delivery being produced for the service under discussion by a number of impellers operating in series in a casing, and possibly two or more casings operating in series. If the speed is constant, any variation in delivery is accompanied by a change of delivery pressure, usually a slight rise as the delivery falls off and a fall of pressure if the delivery increases. This is shown in Fig. 2.

If the delivery falls below approximately 50 per cent of the rated capacity, the compressor will cease to deliver regularly and the discharge pressure will pulsate more or less rapidly. The delivery at this capacity is referred to as the "pumping limit" of the compressor and if the unit must operate below this value of delivery, other means must be provided to prevent the so-called "pumping" which would result.

This so-called pumping limit is the lower limit previously referred to where the compressor ceases to be self regulating. The upper limit is only that imposed by the permissible fall of discharge pressure below the desired operating pressure.

At maximum capacity the usual backward-bladed impeller is most suitable for this service since the characteristic pressure volume relation is such that with increase of delivery the pressure falls off sufficiently to prevent overloading of the motor, in a manner similar to the centrifugal pump.

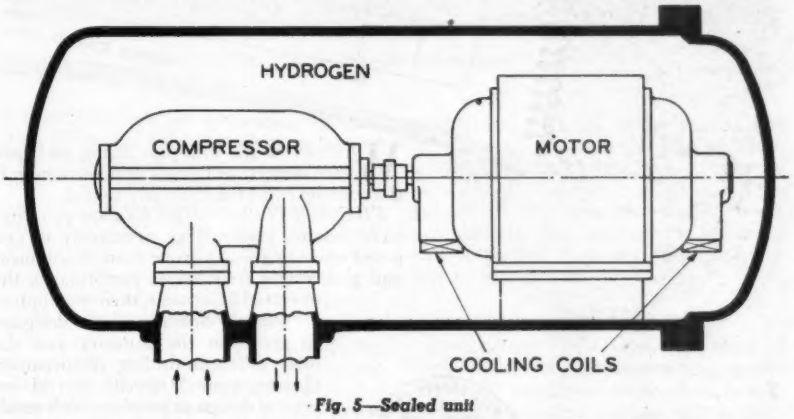

Fig. 5—Sealed unit

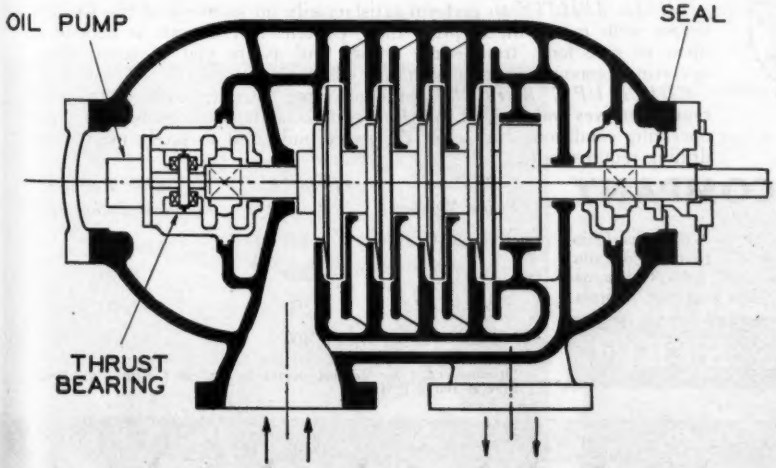

Fig. 4—Cross-section of enclosed multistage centrifugal compressor with single, full-pressure shaft seal

The pressure-volume relation, as shown by the curve, is also such that comparatively small changes of volume are accompanied by proportional changes in pressure, and for this reason two or more machines may be operated in parallel if desired with reasonable distribution of load between units. With the use of radial-bladed impellers the pressure change is very small with a given volume change therefore it would be difficult to operate this type machine in parallel as there would be the constant danger of one machine taking all the load.

Regulation

The capacity of centrifugal compressors may be varied in a number of ways:

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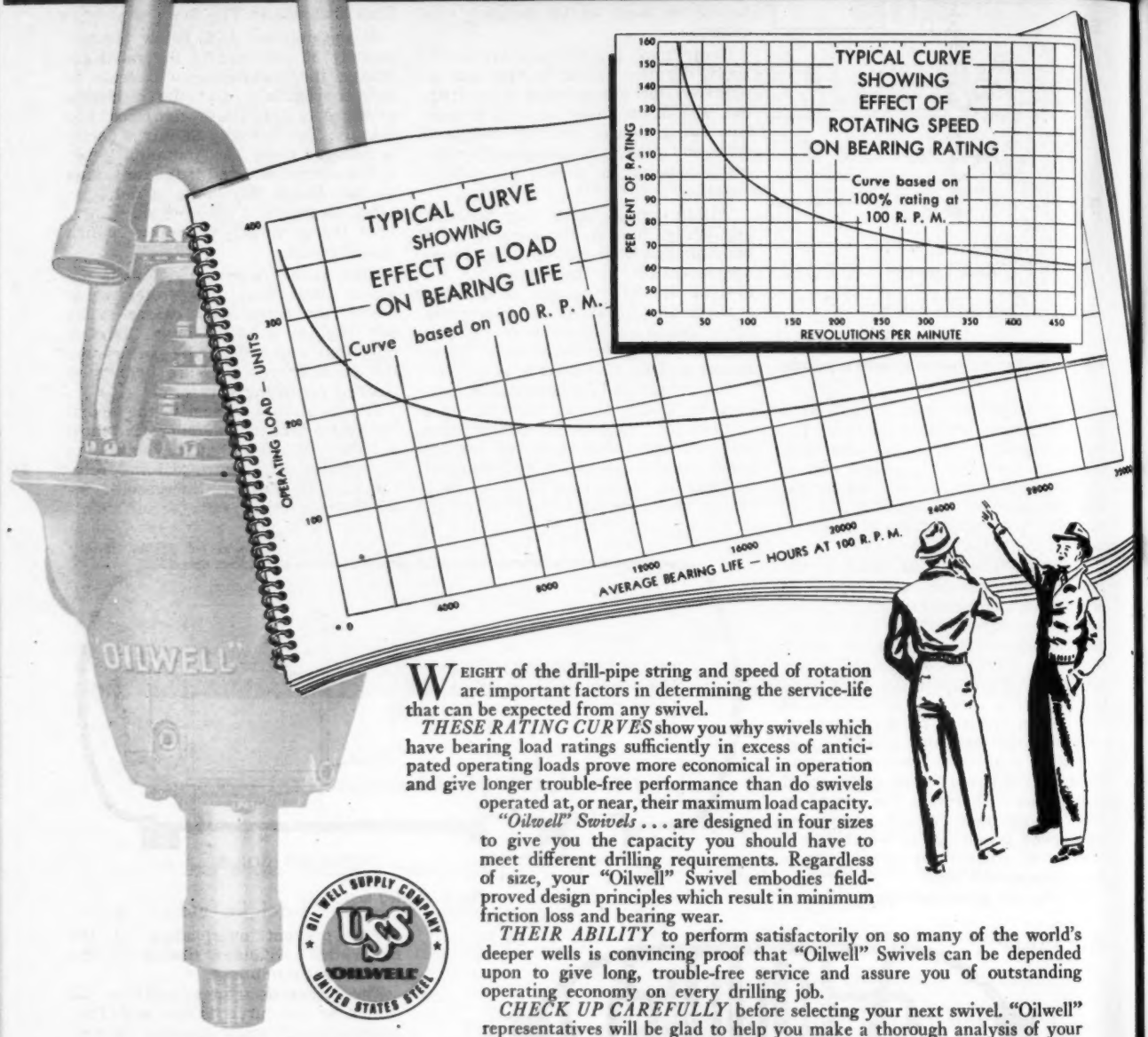
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Fig. 6—Lower half casing of centrifugal compressor for 350-psi. pressure

1. By small speed variation. This, however, is limited, for constant pressure, to a minimum volume not greatly less than the "pumping" limit previously referred to. This method is the most efficient in power saving. The electrical control equipment for variable-speed motor drive is, of course, quite expensive.

2. By throttling the inlet to the compressor. This has about the same limitation that the speed-varying method has, but the power losses are larger.

3. By means of adjustable inlet guide vanes (prerotation). This method, in modern practice, usually involves the installation of adjustable turning vanes at the inlet of one or more stages of the compressor, the purpose of which is to impart an initial whirl to the gas as it enters the wheel, thus reducing the pressure rise through the impeller without the complete loss which would result from throttling the inlet, and at the same time, permitting far greater reduction in capacity than can be obtained by straight throttling.

4. Power-recovery means. In this method the excess compressed gas is passed through an expansion turbine and bypassed into the suction line of the compressor. This method saves power but requires added expensive mechanical equipment, thus adding to the first cost. The power-recovery means are sometimes built into the compressor proper. This method provides very wide range in capacity with power-saving features.

5. Regulation by reduction of delivery of compressors at producing field. Since the pressure ratio is dependent on the gas density, the capacity of the line may be varied by slowing down the field delivery to the main line. This will lower the pressure in the line and the booster compressors will operate at constant speed with the same inlet volume but a lower pressure rise, thus the capacity of the line in pounds of gas per day will be reduced.

6. Much the simplest means of regulation for operation below the pumping limit is the bypass method. In this method an automatically controlled valve bypasses gas from the discharge to the suction in just sufficient amount to maintain stable operation above the pumping limit. This method is positive, reliable, and simple but naturally the energy used in compressing the bypassed gas is wasted and the method is not recommended where long periods of operation at much reduced capacities are encountered. Also, if considerable gas is bypassed for any length of time, a cooler in the bypass line to remove heat of compression is advisable. This gas could be used for useful work but usually the amount is so small and irregular that it is not economical to attempt it.

Fig. 8—Impeller construction

Operation

Centrifugal compressors, in view of their inherent characteristics, probably will require that somewhat different installation and operating techniques be used. In the first place, a

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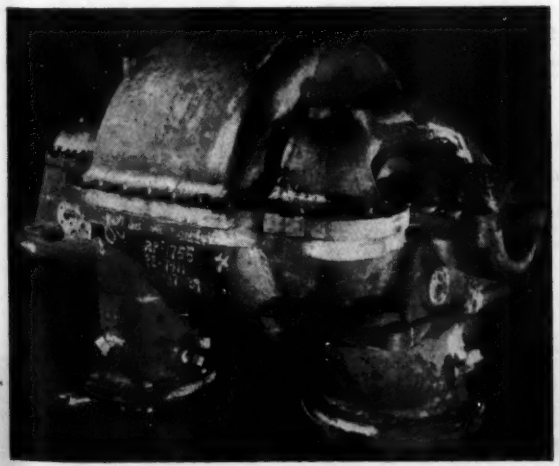
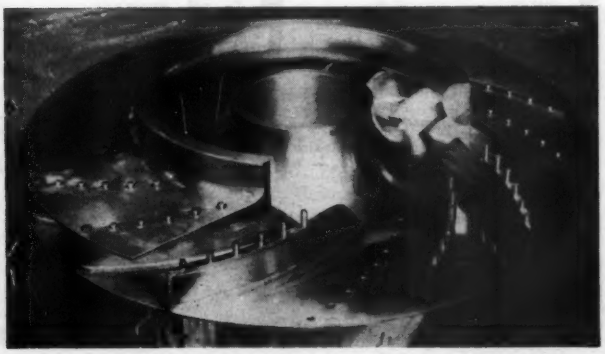
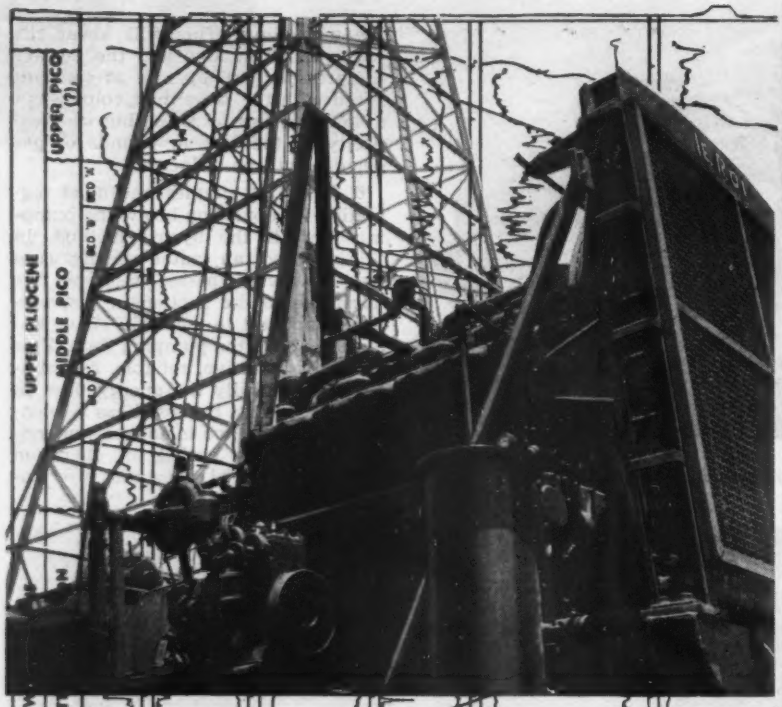


Fig. 7—(Left) Casing of centrifugal compressor for 350-psi. pressure

Fig. 9—(Below) Impeller construction





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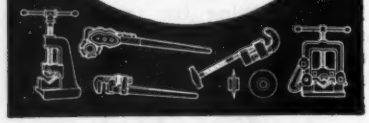

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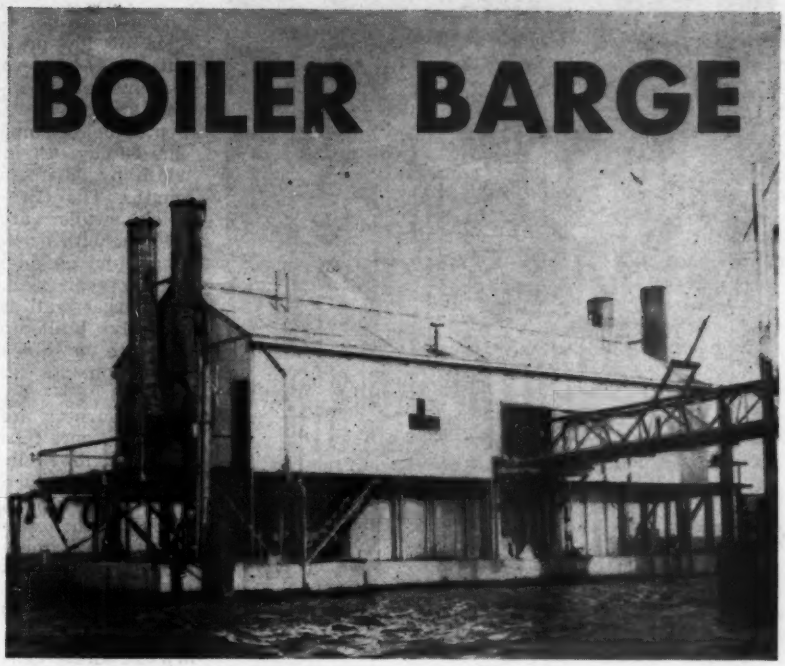
Refitted BOILER BARGE

Contains Unique Features of Design

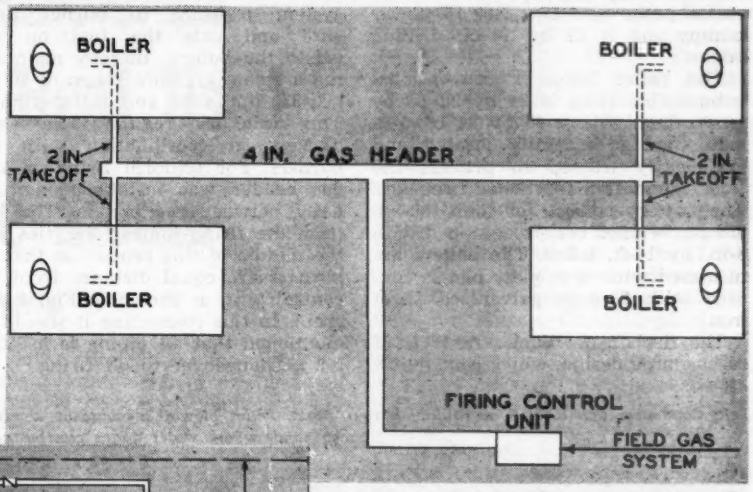
by E. H. Short, Jr.

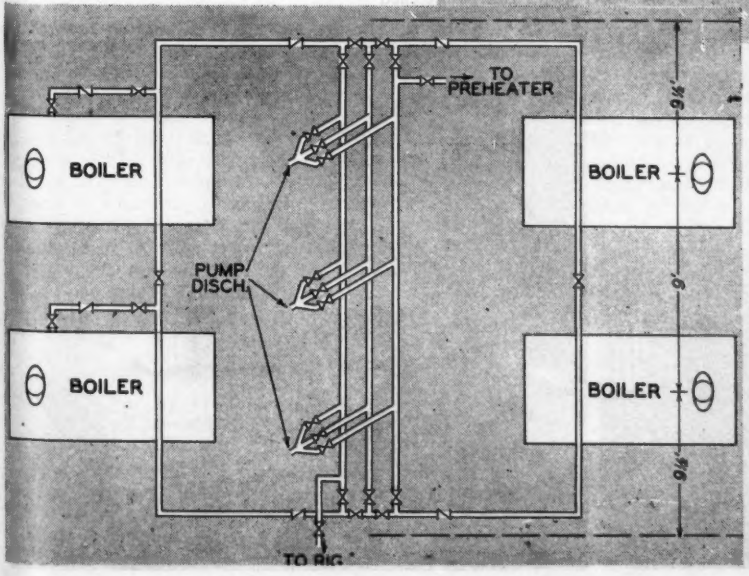


IN Quarantine Bay field, Louisiana, located east of the Mississippi Delta, Gulf Refining Co. recently placed into operation a refitted boiler barge. At the present time, this barge is furnishing power for rig No. 54 which is being used to drill a 12,000-ft. test in that area.

While there are larger and more powerful boiler barges in operation along the Gulf Coast, an inspection of this particular barge revealed a number of excellent design features which make it outstanding.

The conversion of equipment is always a subject of considerable interest, since the attention devoted to economics and engineering ordinarily involves not only a great amount of study as to the mechanics involved, but often results in the display of greater ingenuity than required in the development of a new project. The Gulf rig was originally designed to operate with a minimum requirement of fuel and water in drilling undeveloped areas. Two boilers and a superheater were adequate





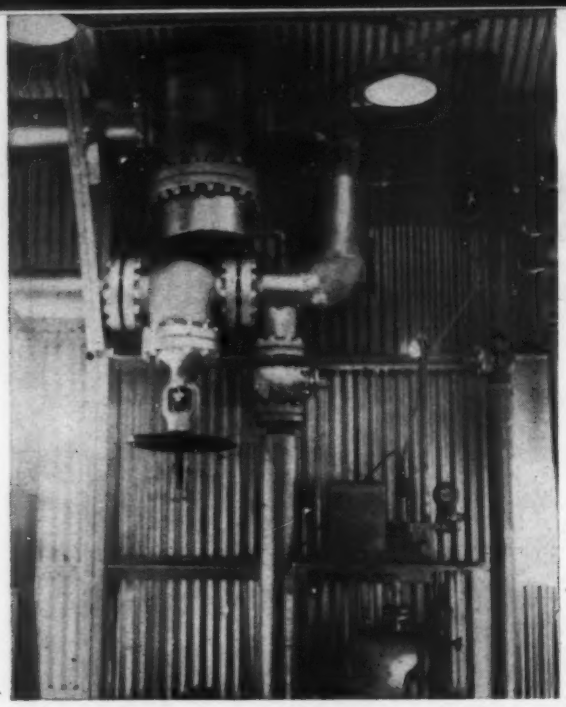
Top of page: Gulf Refining Co.'s refitted boiler barge. Equipped with four 150 hp. welded boilers, this barge furnishes power for Gulf Rig 54 now drilling a 12,000-ft. test in Quarantine Bay field

Above: Four-inch gas-header system designed so that all burners are equidistant from control unit

Left: Diagram showing pump-discharge manifold, which permits feeding of boiler from any pump from either direction

for this purpose. However, subsequent development of fields in this area and the need for deeper drilling made heavier equipment and more power mandatory and outstripped the original design.

The Gulf rig was converted from two No. 18 power pumps and a 12 by



Steam separator with trap

12-in. drilling engine to one No. 20 steam pump and two No. 18 power pumps and a 14 by 14-in. drilling engine.

The boiler barge, a conventional submersible type, is 84 by 28 ft. by 10 ft. deep with a 40 by 24 by 5-ft. water tender centrally located and sufficiently trussed to provide the floor foundation for boiler fireboxes. The battery consists of four 150-hp. 350 psi. welded boilers equipped with 3-in. by 14-ft. tubes. The boilers are insulated with spun-glass panels covered with 26-gage galvanized sheet iron.

The firebox or "duck's nest" is of rather large design, which contributes to better performance of low-pressure gas burners. The inside dimensions are as follows: depth below mud rim 33 by 64 in. width by 98 in. in length. The firebrick walls are 13½ in. with a 32-in. circular air duct in the rear wall. The target wall is partially built to facilitate a quick conversion to oil firing.

The burners are a low-pressure type firing 12 to 18 lb. and are constructed for easy removal through the air duct by simply breaking out hammer unions.

In the gas fuel system an automatic firing-control unit reduces the field-gas-system pressure to burner pressure and cuts the fuel on and off to the boilers, thereby maintaining a steam pressure range of 10 lb., i.e., 330 minimum and 340 maximum. This unit also regulates the stack blowers in coordination with the burners. For uniform firing, a 4-in. gas header was installed longitudinally between the boilers. The line from the firing-control unit ties into the middle of this header, so that all burners are equal distance from the control unit, as shown in Fig. 1 diagram. In this connection it should be mentioned that all piping is in place for a changeover to oil firing.

The feed-water system and generators are unitized skid mounted to include three 10 by 5 by 10-in. pumps with the feed-water heater mounted over one pump and two 15-kw. direct-driven steam-turbine generator units. The pump-discharge lines, steam line, and exhaust line are all integrally fixed under the units within the skid beams. This unit is now standard practice on all Gulf barge-type rigs.

The pump discharges are manifolded into a three-line hookup which enables the fireman to feed any boiler from any pump—and from either direction. A line failure could hardly interrupt operations with this Gulf-designed manifold.

The suction manifold is a similar three-line hookup so designed that any one of the pumps can pull from the tender, from the heater or from an adjoining water barge.

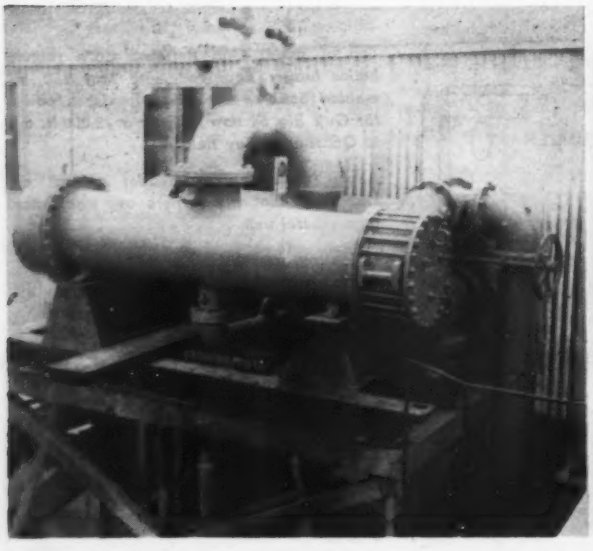
The steam headers are 6 in. and are equidistant from all boilers, and the main steam line to the rig is 6 in. All are insulated with 85 per cent magnesium pipe-formed insulation covered with galvanized sheet iron.

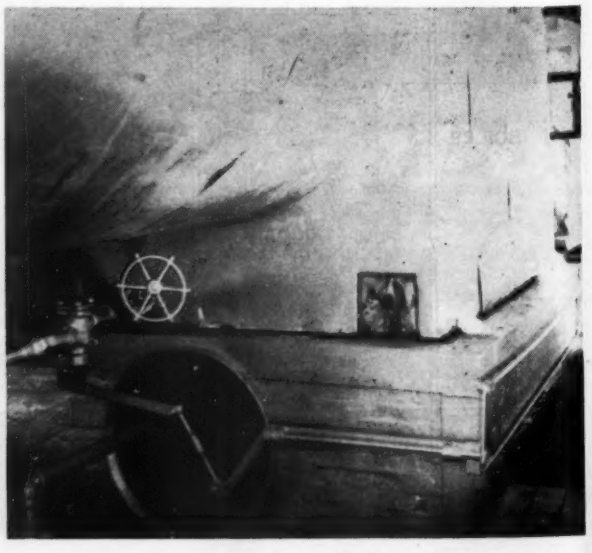
A chemical injector, operating on gas from the burner line, feeds steam cylinder oil into the main steam line. In addition to this, each steam unit is equipped with forced lubrication.

The condenser unit consists of two floating head condensers manifolded together and discharges to the hot-well and oil-skimming unit and then to the water tender.

The Gulf boiler barge is equipped with a chemical treater for treating water. The chemical solution feeds into the boiler feed pump suction and treats the water before it goes into the heater to eliminate deposition in the heater.

Left: Condenser unit located on drilling barge. Right: Boiler blowoff mechanism—operates valve (extreme left) from front of boiler (right background) where water gages can be watched





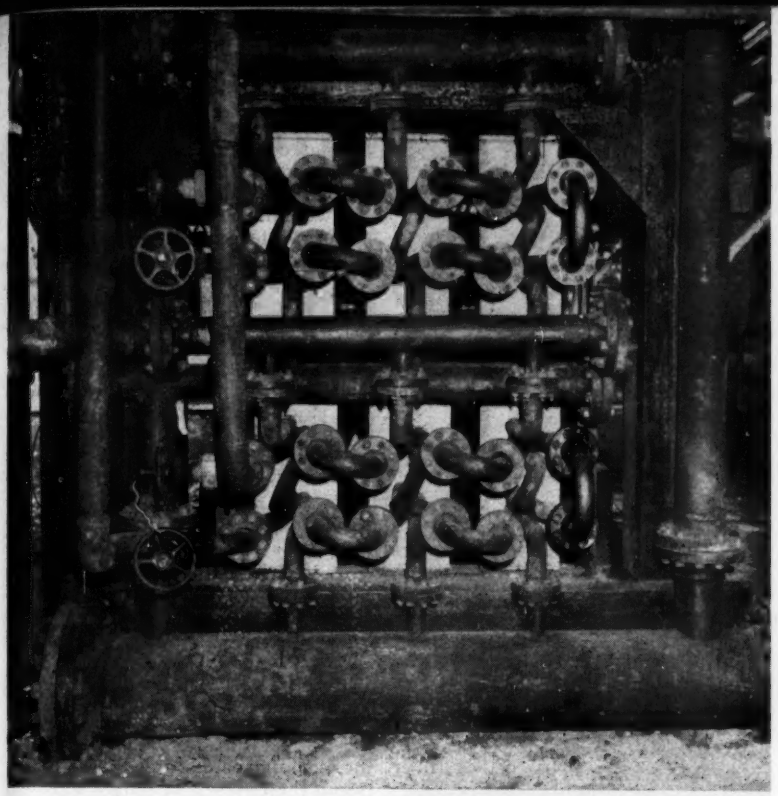


Fig. 1—Manifold and crossover arrangement on steam generator

Plant-Process Heat Used To Generate Steam

by R. B. Tuttle

RECORDS on performance of an additional steam-generating unit installed recently in the Allen, Okla., refinery of Sunray Oil Corp., indicate that the unit supplies normally more than 30 per cent of the steam used in the refinery's usual operations. According to design calculations, the unit, when operating at maximum, is capable of evaporating 70,000 lb. of feed water per hour at a pressure of 125 psi. Heat to the unit is supplied from the refinery's three-coil cracking plant which, for maximum conditions of cracker operations, is 6 million B.t.u. per hour, according to measurement.

Two heat-transfer units are employed in the hookup; the first in the system is a series-parallel coil in the convection section of the cracking furnace. This coil is made up of sixty-six 2⅜-in. o.d. by 44-ft. tubes which are placed 12 in. above the oil convection bank tubes, and are the same type as used in the oil section of the furnace. The 11 coils of 6 tubes each are rolled into inlet and outlet headers. Return bends for the coils are the same type as those used in the oil section of the furnace. The steam generator system was installed at the suggestion of Universal Oil Products Co. engineers who also developed its design. Preheat coils are installed in a U.O.P. thermal cracking furnace.

Water entering the second heat-exchange unit in the system is divided into six streams which provide parallel and series flow countercurrent to two cracked-residuum streams. For safety reasons, principally, Tube-flow sections are used in the residuum-to-water section of the generator. Twelve 2½-in. steel-finned sections having an effective length of 28 ft. provide 382 sq. ft. of heat-transfer surface for the water-to-residuum unit. Since the unit is assembled four sections high and three wide and inlet and outlet of both water and residuum streams are located at only one of its ends, the exchanger header arrangement for dividing heating and heated streams is relatively simple, as illustrated in Fig. 1.

Feed water enters the heater coil at temperatures from 60° to 80° F., depending upon atmospheric conditions, and under 300 psi. pressure. The pump which supplies water to the generator and to the refinery's four H.R.T. boiler battery, takes its suction from an elevated surge tank. Treated water is pumped into the surge tank by a low-pressure pump which receives its charge from the raw-water system. Both pumps are centrifugals and are rated at the same capacity but the one which discharges into the surge tank operates at a much lower pressure than does the other which pumps to the steam-generating unit and to the boiler battery.

Some heat is added to the water before treatment but such is negligible since the exchangers employed in the operation function primarily as product coolers and not as feed-water heaters. Normal temperature of the water leaving these exchangers, the first of which is an after cooler at the polymerization plant and the second in similar service on P.D. from the stabilizer, is not high enough to dissolve the treating chemicals which are fed into the system at this point. To provide water at suitable temperatures for dissolving the chemicals a slip stream is taken off at the feed water heater. This stream enters a Nalco ball chemical feeder which discharges into the suction side of the feed water makeup pump.

The discharge from the feed-water pump splits into two streams, one of which is heated with a G-Fin unit for use in the H.R.T. units, and the other delivered to the coil in the cracking furnace. Heat exchange at the G-Fin unit raises the water temperature to around 20° F. above that of 125-psi. saturated stream. Cracking-plant residuum also supplies the heat transferred at this point. However, the residuum does not come directly to the exchanger as in the case of the generator but instead the hot side of the G-Fin unit is in series with the generator unit. After passing through this last exchanger, residuum is run to a cooler-box coil and thence to storage. A temperature controller installed in the residuum line operates to maintain constant temperature on the water outlet.

This arrangement takes care of variations in feed-water demand at the H.R.T. installation simply by shunting or bypassing residuum direct to the cooler box. Since the generator is maintained at constant steam-production rate, all steam-production variations necessary to meet plant demands are made in the operations of the H.R.T. boilers. Calculations show that the four boilers, when considered as a unit, operate at 100 per cent of rating during the time the generator is in service. The normal per cent of rating figure on the boilers rises possibly to 115 when the generator is out of service during a scheduled shutdown of the cracker.

Temperature of the hot residuum entering the generator averages 830° F. with a maximum variation from this average of a few degrees plus or minus in normal operations. Average outlet temperature on the residuum side of the generator is 540° F. and by the time this stream reaches the boiler feed-water heater its temperature has dropped to 525°-530° F. Temperature of the water out of the generator is in the range 364°-368° F.

The water stream from the generator unit enters a disengaging drum which is elevated to 22 ft. and is equipped with a liquid level controller for maintaining its water level. The motor valve in the liquid-level control system is in the line which runs to the coil in the cracking heater convection section. A Reliance "Eye-Hye" liquid-level gage serves as a check on the operations of the level controller. This gage is located at ground level and in a convenient position where any of the plant's operators may check liquid height from a distance as great as 25 or 30 ft. Back lighting makes night-time reading of the gage an easy matter. The gage as installed at Sunray's Allen refinery is illustrated in Fig. 2.

Raw water for cooling and for steam generation at the Allen plant is obtained from a 500-ft. well located ½ mile from the refinery and from surface water reservoirs. The well supplies about 40 per cent of normal water demand with the remainder coming from two reservoirs which are located approximately ½ mile apart and 3 miles from the refinery. Surface water is pumped to the plant with a gas-engine-driven unit at varying rates, whereas the well water is delivered at 90 g.p.m. with a Pomona deep-well unit. Two 10,000-bbl. tanks and an earthen reservoir provide storage for emergencies and for other purposes. The schematic diagram, Fig. 3, illustrates the water system as it is operated now for supplying cooling and boiler feed water.

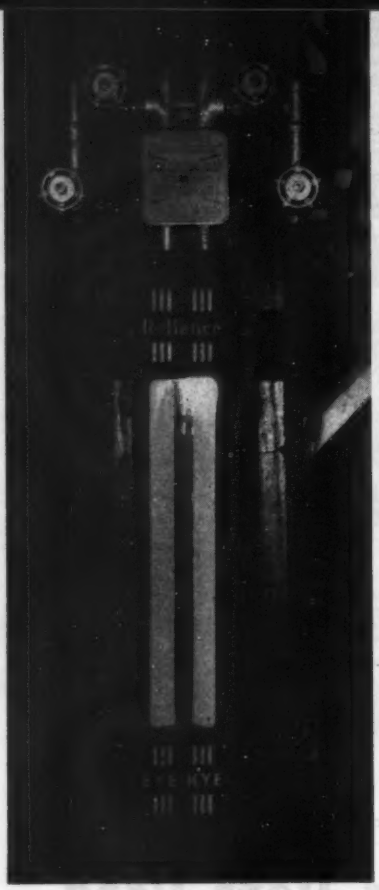


Fig. 2—Remote liquid-level gage for steam disengaging drum

On the cooling-water section of the system one pump takes suction on the hot well and discharges to the cooling tower. Water from the cooling-tower sump is handled with the same type unit as used in hot water service, this pump discharges into the plant's cooling water system. Both pumps are provided with turbine-driven standby units whiich are placed into service automatically in case of electric-power failure. The steam-powered pumps run continuously at idling speed in order that they may pick up the load when cut in by the automatic controllers.

Suction to all four of the pumps is taken off of a common header which runs directly from the hot well to the cooling tower sump. The header has no block valves other than those in the branches leading to the pumps. Since the heads in the well and in the sump are equal and the delivery rates on each of the hot and cold-water pumps are balanced to compensate for differences in density of the hot and cold water, no flow between the two sets of pumps exists in operation.

The water system as currently operated at this refinery includes most of the equipment installed originally when the plant was processing less than one-half of its current capacity of 12,000 bbl. per day of crude-oil charge and some 7,000 bbl. of cracking charge. Expansion of the water system and of the steam-generating facilities, up to date, has been made on an economical basis and according to records the arrangement operates at high efficiency.

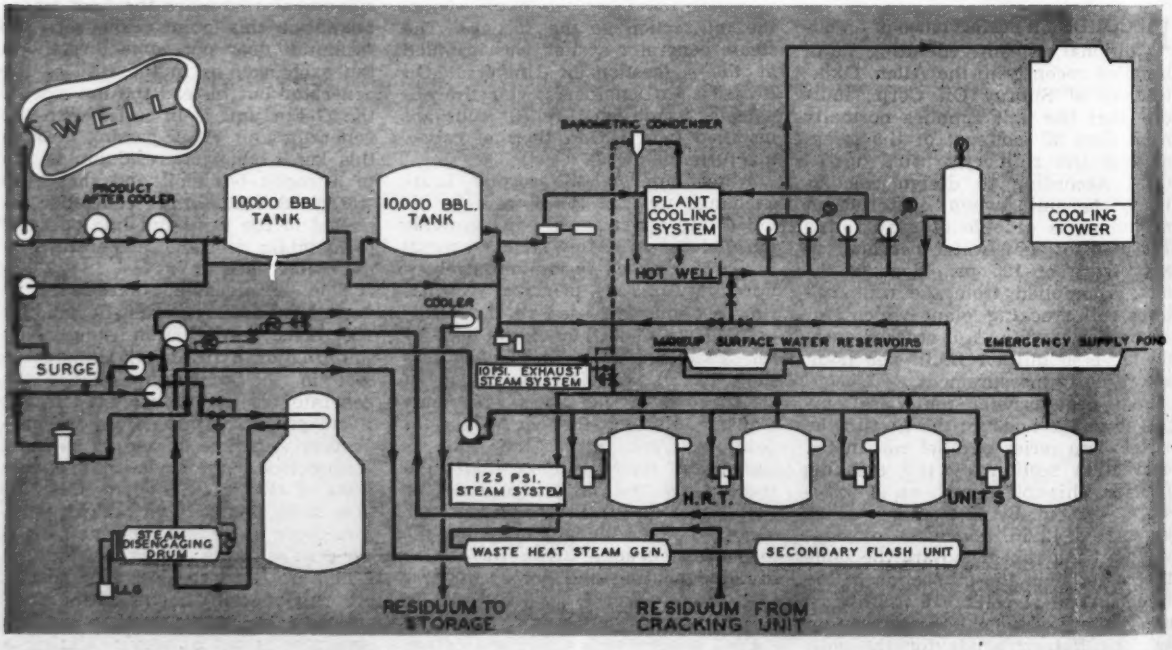
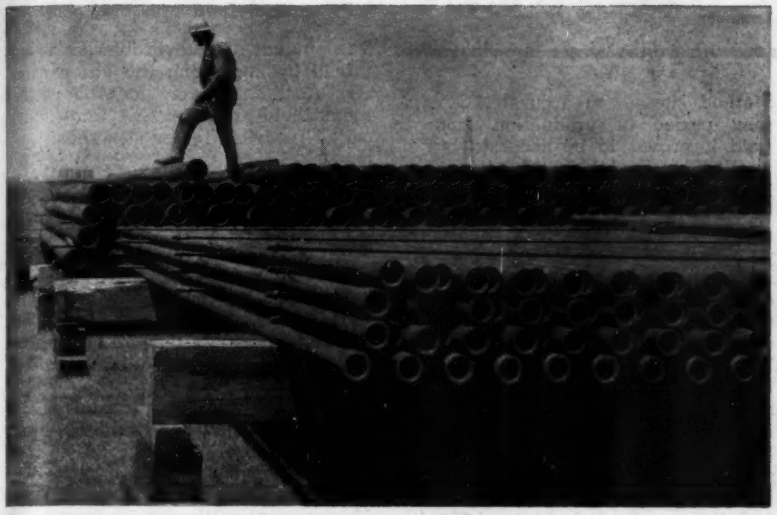


Fig. 3—Schematic arrangement of water and steam systems in Sunray refinery at Allen, Okla.

OPERATING IDEAS

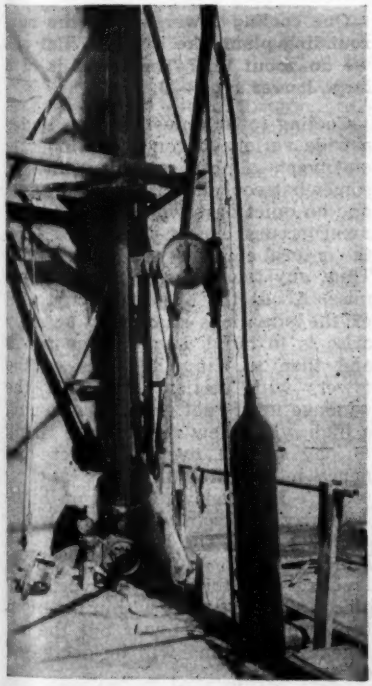


Salvaged Sucker Rods for Pipe Spacers

UTILIZATION of salvaged sucker rods instead of boards for spacers for racked pipe has greatly facilitated the handling of pipe on the rack for one large drilling contractor. With the rods it was found that one man could do the work of two in rolling the pipe from the truck to the rack, or from the rack to the runway. Also, the sucker-rod coupling pins serve as an effective block to prevent the pipe from rolling off the rack accidentally.

Enclosed, Lubricated Tong Counterbalance

THE tong counterbalance on one rig in West Texas consists of a weight box which moves up and down in a section of 10-in. casing set through the derrick floor at one side. The weight box is hung on a rod, cut from salvaged polished rod from a pumping well, which works through a lubricated opening in the top of a swedge nipple on the upper end of the 10-in. casing cylinder. The bottom end of the casing is sealed to retain lubricant for the reciprocating weight box. A small door in the side of the upper end of the casing above the derrick floor permits access to the interior for adjustment of weights to obtain proper tong balance.



Lifting Device for Well Connections

WELLS in many cases are permanently equipped with an extended lubricator assembly and elevated sheave mast for running paraffin scrapers, bottom-hole pressure bombs or other service tools. A simple arrangement for lifting this assembly from the top of the well when inserting the tools has been devised by a Gulf Coast operator. A level arm is hinged within reach height to the elevated ladder support. The lever works a light cable which extends over a sheave in the top of the ladder support to a clamp on the upper end of the lubricator extension assembly. With the device, one man can raise the assembly from the well and allow it to hang at one side while inserting the service tool. Formerly two men were required to handle it.

Container for Small Tool Parts or Fittings

AN easily carried, rectangular-shaped wooden box of shallow depth and partitioned into compartments of different sizes and shapes according to needs provides a convenient place on one rig in which to keep various small tool parts and replacements. The compartments permit parts to be placed in orderly fashion, where they can be found quickly, instead of being thrown haphazardly into some bin with a miscellaneous assortment of fittings, etc., as is done customarily, and where they are difficult to find and pick out. The bottom and the hinged wooden top are protected against damage by a thin sheet-metal covering.

QUESTIONS on TECHNOLOGY

by W. L. Nelson
Consulting Engineer

Converting to Oil Firing

We are converting from stoker firing to oil firing on our boilers. What are the advantages of steam-atomizing oil burners?—R. M. P.

The construction of steam-atomizing burners is simple, the oil need not be heated to as high a temperature as for mechanical burners (see The Refiner's Notebook No. 127, The Oil and Gas Journal, January 18, 1947, "Fuel Oil Properties"), pump pressures are low (40-60 psig. for residual fuel oils but up to 125 psig. for distillate fuel oils), and maintenance costs are very low. The firing of oil has been discussed in The Refiner's Notebook No. 131 (The Oil and Gas Journal, February 15, 1947). As compared with the firing of coal by means of a stoker, only a small furnace draft is necessary. Natural draft is employed almost universally but in converting to the use of oil, the size of the burner dampers should be checked to be sure they are large enough to admit adequate secondary air when the boiler operates at a lower draft. A little less excess air will probably be required when burning oil (50 per cent or less) unless the present coal firing setup is an excellent one. A bridge wall can be used but it is not necessary. If a bridge wall is used, it should be set far back in the furnace (two-thirds of length or more). The floor should not be air cooled because a cold floor hampers the combustion of the oil, air leaks can occur, and it will conduct useful heat away.

Estimating Gas Reserves

We would appreciate it if you could tell us if there is a simple formula or chart available for figuring the gas reserves from several gas wells in certain known defined areas. Information on literature covering this problem will be appreciated.—P. H. Z.

Simple formulas are available but the complexities of underground formations are not simple and hence the selection of the constants or factors that should be used in the formulas involve experience or good judgment. One of the clearest references on the subject of valuation is Paul Paine's book entitled, "Oil Property Valuation," published by John Wiley & Sons, New York, 1942.

Theoretically, the **Pressure Volume Method** should be accurate. Over a long period of production from a field it proves to be accurate but if applied during the early life of a field it tends to give low or conservative valuations. The method depends upon the fact that the reservoir volume remains substantially constant (except for possible water encroachment) throughout the life of the field. Likewise, the temperature remains constant. Thus, the pressure in the reservoir is a direct function of the amount of gas remaining in it at any time. Before making pressure readings, the field should be shut in long enough to obtain a constant pressure. As an example, if the closed-in pressure of a new field is 1,440 lb. and the pressure drops to 1,350 lb. while 150,000,000 cu. ft. is being produced, the rate of pressure drop is 150 ÷ (1,440 — 1,350) or 1,667,000 cu. ft. per pound of pressure drop. The total production will depend on the final economical field pressure. If it is thought to be 200 psi., the recoverable gas will amount to:

$$1{,}667{,}000 \times (1{,}440 - 200)$$

$$= 2{,}067{,}000{,}000 \text{ cu. ft.}$$

All of this might be expressed algebraically as:

$$V = v\,\frac{P_1 - P_2}{P_2 - p}$$

in which:

P_1 = initial field pressure, psia.
P_2 = retirement field pressure, psia.
p = intermediate field test, psia.
v = volume produced up to time of field test, cu. ft.
V = estimated total production, cu. ft.

If the field has not been in operation or if intermediate test pressures have not been recorded, the **Saturation Method** may be used. This method requires a knowledge or estimate of several factors such as reservoir temperature, reservoir pressure, porosity of sand, thickness of sand, amount of connate water, etc. These variables are related as follows:

$$G = 1{,}575\,\frac{ASMOP_1}{(T + 460)}$$

in which:

G = gas content of reservoir, std. M.c.f.
A = area of proven tract, acres
S = sand thickness, ft.
M = porosity of sand, fraction of sand volume
T = temperature of reservoir, °F.
O = saturation factor, space occupied by gas as a fraction of the pore space
P_1 = initial field pressure, psia.

The amount of recoverable gas is obtained by correcting the gas content (G) of the reservoir for the retirement field-pressure (P_2) and a so-called recovery factor (R), thus:

$$V = GR\,\frac{P_1 - P_2}{P_1} = 1{,}575\,\frac{ASMOR(P_1 - P_2)}{(T + 460)}$$

The value of the recovery factor (R) should generally not be over 0.6. It involves such corrections as deviations from the ideal gas laws, encroachment of water, absorption of gas by minerals, sealed off regions, etc.

The porosity (M) of gas sands varies widely but an average value is about 0.2. The saturation factor (O) is necessary mainly to care for connate water. Connate water may amount to 40 per cent although ordinarily it amounts to only 10-12 per cent of the pore space and may be even lower in gas evaluation.

Monograph 7 of the U. S. Bureau of Mines entitled, "Back Pressure Data on Natural Gas Wells and Their Application to Production Practices," does not discuss the estimation of reserves but it contains many data on gas wells, their testing, and operation.

Windage Loss in Cooling Towers

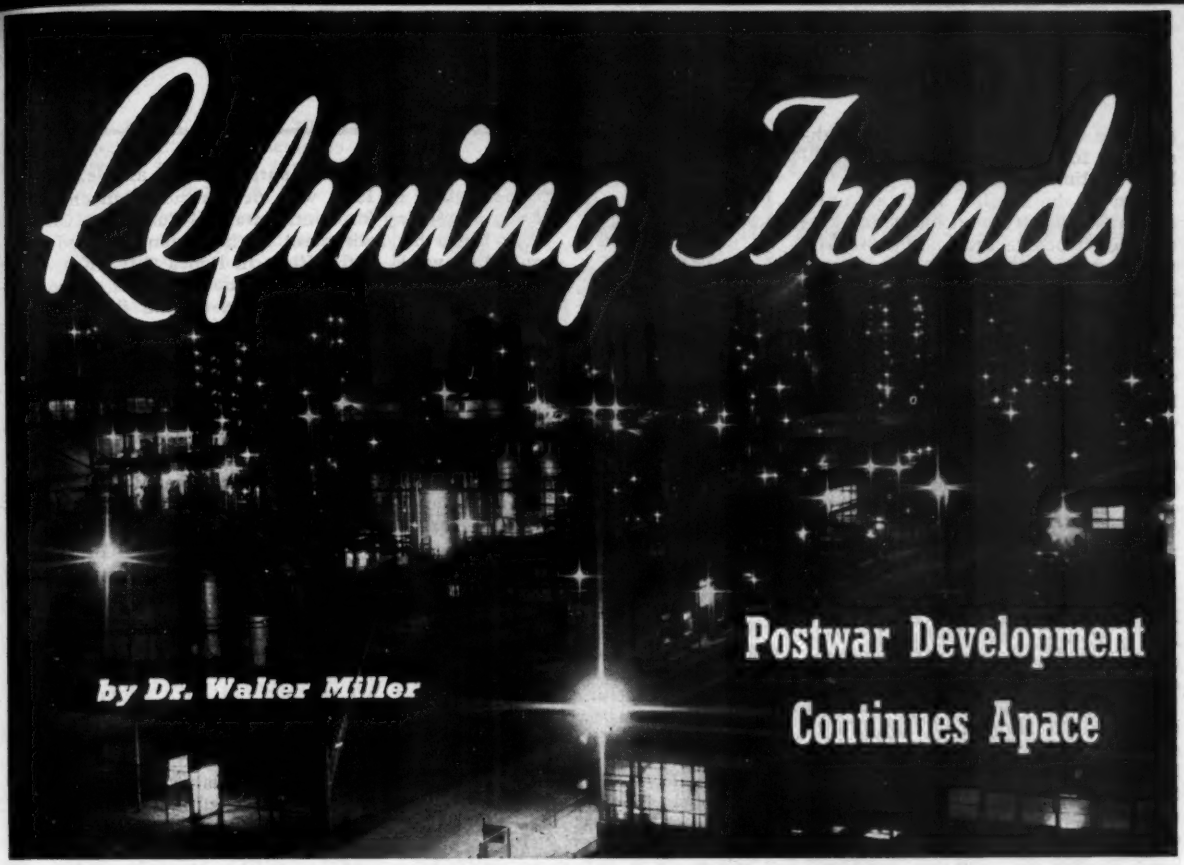
Our cooling tower sprays the surrounding plant like a rain. What can we do about this? The tower is of a large louver type.—D. F. B.

Cooling towers must operate under a wide variety of conditions; operate on moist, almost saturated air, on somewhat cool days, in a high wind, and on quiet days when no air movement occurs except that caused by the natural currents within the tower. Thus, any tower design is a compromise. About the only solution to all of the situations that may possibly arise is to build a very large tower and then so shut the sides of the towers with vertical slats that the windage loss is not great even during a high wind. Few refiners are ready to pay for an oversize tower and hence most installations are a compromise between water loss on high-wind days and somewhat warm water on quiet days. The bad windage loss indicated in the question can be alleviated by the use of vertically placed slats or boards within the main framework of the tower but the efficiency of cooling will be decreased on quiet days.

Refining Trends

Postwar Development Continues Apace

by Dr. Walter Miller



A refinery's operation continues around the clock, with three 8-hour shifts of operating employes manning the furnaces, pumping units, cracking plants, and distillation columns. Photograph taken at Shell Oil Co., Inc.'s, Wood River, Ill., refinery where 90,000 bbl. (approximately 3,800,000 gal.) of crude oil daily are processed into useful petroleum products

A SURPRISING development during the year was the continued high demand for petroleum products and the high level of crude-oil charges to the stills. Generally speaking, the petroleum industry during 1946 succeeded in producing a greater quantity of crude oil and petroleum products than in any of the war years, and considerably exceeded any prewar year in history. Daily crude still charges averaged between 4,700,000 and 4,800,000 bbl. per day for 1946 and about equaled the 1945 record, although most pessimistic 1945 guesses and predictions or fears ranged for 1946 from only 3,900,000 to 4,400,000 bbl. per day. In spite of the high crude charge to the stills, total stock of crude oil was higher at the end of the year by some 7,000,000 to 8,000,000 bbl.

The same story holds regarding stocks of the principal refined products. Gasoline on hand at end of year was 2 to 3 million barrels lower, and was considered low for the anticipated demand during the coming high consuming season, while stocks of light and heavy fuel oils, although some higher than a year previous, hardly reached a comfortable level.

The trend in gasoline of high octane number, which has resulted in a marked rise in the antiknock quality by the end of 1945 (five or six numbers higher than during the war and one number higher than the prewar quality of civilian motor gasoline of 1941) was abruptly arrested by an acute shortage of metallic lead for manufacturing tetraethyl lead. Government action in the form of lead-price control, rationing, and the setting of octane-ceiling specifications to conform to the reduced ethyl lead compound available were enforced until abrogated at the end of the year. It will be interesting to see how rapidly the octane levels will resume the rising trend, as more metallic lead slowly becomes available for making greater quantities of ethyl lead compound.

Better Road Performance

As octane quality rises over present levels the disadvantage of the refiner without catalytic cracking equipment will increase. Gasoline made by catalytic cracking, without addition of ethyl lead, approximates 77 octane by the official A.S.T.M. motor method test, compared with 66 for gasoline generally similar in volatility made by the older thermal-cracking operation. Catalytic gasoline shows an even greater improvement in the research octane number, the comparison being roughly 86 research versus 71 research octane for the thermal-cracked product. This higher differential in research octane is credited by many, although not universally so, as contributing to better road performance, and consequently resulting in a more desirable product marketwise.

In some parts of the country a premium of roughly ¼ cent per gallon is now being paid for gasoline with higher research octane made possible by including catalytic-cracked product in the final blends. If such price differentials in favor of catalytic gasoline become general, it will add further to the disadvantage of the noncatalytic refiner.

The economic problem of installing catalytic cracking in refineries charging less than say 7,500 bbl. of crude oil per day has not been solved satisfactorily. The investment cost per barrel of capacity rises rapidly with reduction in size, and the same applies to operating costs. Therefore unless special considerations peculiar to a specific refinery situation reduce installation costs, by permitting the use of applicable existing equipment not otherwise needed, the above figures seem to be the approximate dividing line at present between economic and noneconomic planning.

Although much has been accomplished in improving design and simplifying operations leading to lower capital investment and better operating costs than was first thought necessary, and although in some cases the urgency of the need for high-octane gasoline will to some extent

override economics, the rule of higher costs for smaller installations will have its limiting effect.

Two of the smaller types of units are under construction and should be completed before the middle of 1947, and much information for future small-plant development is looked for from their operation.

Seven of the wartime Government-built catalytic cracking units are in operation. Two of these have been purchased by the respective refiners, and five are being operated under rental arrangements with slow negotiations going on looking to possible purchase by the refiners. Seven of the total of 14 are idle, and 4 or 5 of these are so situated that they hold little prospect of ever being utilized.

Since V-J Day some 10 additional large-size catalytic installations have been started in the United States, with 2 or 3 of them completed and in operation, the rest in various stages of construction.

Many additional catalytic-cracking projects and situations are under study and in prospect. Impending higher octane standards will continue to make that one of the most important problems confronting the refiner not yet so equipped. As the situation clarifies and construction materials become increasingly available new installations will be initiated rapidly.

A postwar note on 100-octane aviation gasoline is to the effect that the 30,000,000 to 40,000,000 bbl. on hand at the close of fighting have been almost exhausted, and the Government will in a few months resume buying for current requirements.

Lubricating Oil

It will be remembered that at a number of times during the war, fears arose as to the ability of the refiners to make all the lubricating oils required. A number of projects for increasing the manufacturing capacity were proposed and engineered, but not authorized by Washington for installation during the war. Experience indicated that sufficient lubricants would be made by refiners and therefore the expenditure of large quantities of construction materials needed elsewhere could be avoided. Four or five of these delayed projects were well along and should be among the first new installations to get into operation.

A recent survey indicated that some 20 projects, including the ones mentioned above, and many including wax-manufacturing equipment, were on the active list for the United States. Several of these plants have been contracted for, and the rest are in various stages of planning, estimating, or contracting negotiations. Most of them are sure of ultimately being carried through to completion over the next 2 years or so.

Many of the installations will be for new capacity and all for solvent-treating processing, but a substantial proportion is to be replacement capacity to supplant existing old acid-type plants reaching toward obsolescence, as well as two or three early-type solvent-treating plants no longer competitive. Although the figures given here are only approximate, the indications given by the private survey referred to are that a total of 30,000 bbl. per day of new capacity is planned, but 18,100 bbl. will be to supplant a similar capacity of the older plants to be discontinued as the new solvent-treating replacement installations are put into service. A net increase of approximately 10 per cent in total manufacturing capacity will be added to the present average 120,000 bbl. per day U. S. capacity. An appreciable rise in quality level will result, and like the refiners without catalytic cracking, the plants without solvent treating and the resultant higher lubricating quality will be at an increasingly serious disadvantage.

Some uses for the older-type oils will continue, but solvent-treated quality will generally be used in preference for all internal-combustion motor operations, and application to other services is increasing steadily. The old acid-treated lubricating oils are fast receding from the picture.

Application is broadening of the principle of adding special ingredients in minute proportions to oils for improving lubrication effectiveness. Although of long standing, the practice received a tremendous impetus during the war as the industry was called upon to solve new lubricating problems occasioned by innumerable new and more severe requirements incidental both to manufacturing war machinery and equipment, and service under combat conditions. Much of the wartime development was secret until the war's end, since when the new ingredients and additives have been available for industry-wide use. The ever-continuing search for newer and better additives and ingredients resulted in some recent announcements which are rapidly becoming incorporated in practice.

Research in the petroleum refining art reached out on a widening front through the year as the limitations imposed by previous war requirements were relaxed. Many plans for new scientific laboratories and expansions of existing research installations have been announced on a scale which will provide equipment and space many times that of today. Many new oil companies are joining in the search for new processes, new products, and new knowledge. The large number of research problems successfully worked out during the war years, both as individual programs and the combined efforts of many individuals and companies, constitute a background and starting point for wider and newer efforts. The good augury for greater success in more strongly and integrally welding petroleum and its practically unlimited chemical source materials with the great chemical industry is especially attractive to energetic seekers for greater future progress and profits.

Oil from Other Sources

The Bureau of Mines is developing the technique for manufacture of liquid petroleums from other source materials against the future days when the crude-oil supply falls short. Coal, oil shale, natural gas, and other materials are being investigated as sources; fortunately an immediate answer to the problem is not imperative.

Liquid petroleums from natural gas by the Fischer-Tropsch process should soon have the first full-sized demonstration of its practicability under American conditions. The first commercial installation is being erected near Brownsville, Tex., and will probably be ready for operation early in 1948. It will process approximately 70,000,000 cu. ft. of natural gas a day and produce roughly 5,000 bbl. of gasoline plus 2,000 bbl. of other liquid products available in part as diesel-

DR. WALTER MILLER, author of this article, until he retired in 1945, was vice president in charge of manufacturing for Continental Oil Co., Ponca City, Okla. Since his retirement he has been engaged in consulting work with offices in Ponca City. Known particularly for his work in the development of modern lubricating oils, he was among the first engineers in America to recognize the value and to promote the use of synthetic additives. In 1943 he was awarded an honorary degree of doctor of engineering by University of Tulsa.

It has been Dr. Miller's custom to prepare an annual review of trends in petroleum refining, such as that presented here. In addition to its publication here, the article appeared in the February issue of Mining and Metallurgy, a publication of American Institute of Mining and Metallurgy, of which society Dr. Miller is chairman of the committee on refinery engineering of the petroleum division.

engine fuel and in part raw material for the manufacture of chemicals. A $20,000,000 to $22,500,000 investment probably will be required.

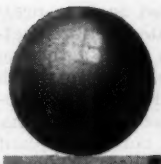
The second installation is planned for erection at the huge Hugoton gas field in southwestern Kansas. Announcement by Stanolind Oil & Gas Co., of Tulsa, is to the effect that approximately 100,000,000 cu. ft. of dry gas will be processed daily. With the later start and somewhat larger charging capacity, it will probably not be ready for operation until late in 1948 or early 1949.

Estimates of total gas reserves in the United States have reached considerably higher figures than the 140 trillion cubic feet quoted at the beginning of 1946, figures of 173 trillion cubic feet estimated as proved and an ultimate potential of 200 trillion cubic feet or more having been mentioned within recent months. Not all of these reserves, however, will be available for Fischer-Tropsch installations, because of smallness of many of the pools and poor location and accessibility. Any figure would be mostly guess, and one might judge that only 25 to 40 per cent of the total could be so utilized ultimately. But if that much is available and usable for making Fischer-Tropsch gasoline it will create a tremendously increased reserve in available motor fuel over the years and push back into the future for many long years the necessity for making gasoline from coal, likely at much higher cost.

The progress being made in this field is being observed closely by all the larger integrated oil companies. A few have evidenced publicly their interest and possible future participation. For the long pull the commercial and practical results of the two large installations now under way will be looked to in arriving at future decisions.

The world-wide crude-oil supply and petroleum-refining situations will be profoundly affected in ensuing years as a result of the recently announced move for Standard Oil Co. of New Jersey and Socony-Vacuum Oil Co., Inc., to acquire substantial shares in the ownership and operation of the vast Saudi Arabia interests of Arabian American Oil Co., now jointly owned by Standard Oil Co. of California and The Texas Co.

A highly augmented rate of crude-oil production in Saudi Arabia, a large pipe line to the Mediterranean, important increases in refining capacity in European and other foreign countries, a lessening drain for export of crude oil from North and South America, a decrease of exportation of petroleum products generally from the United States, as well as lessened dependence of outsiders on the United States refineries for lubricating oils—all these possibilities occur as one speculates on the future.



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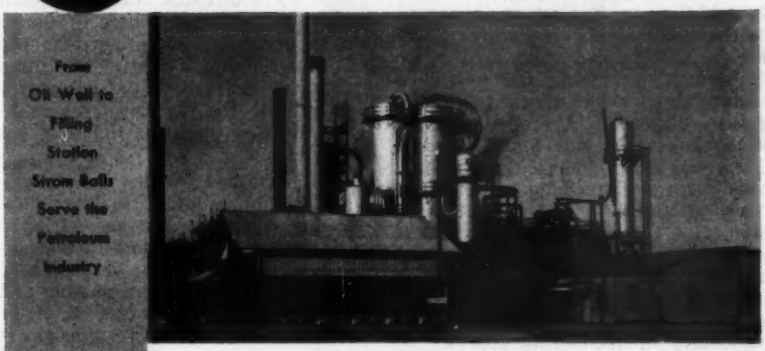

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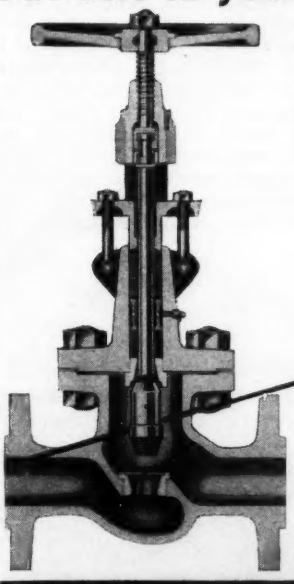

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Sulfur From Sour Gas

(Continued from page 59)

The sourest gas by far is that produced in McKamie-Patton field. It averages 4,250 grains per 100 cu. ft. In addition to finding an Arkansas market for this gas, producers at McKamie were faced with two other problems; sweetening the gas at a reasonable cost and disposing of the great volume of hydrogen sulfide. When a market was found, Girdler Corp. was asked to test the gas in a pilot plant to determine whether the Girbotol amine process would economically reduce the sulfur content to less than the required 0.05 grains per 100 cu. ft. After learning that this could be done, operators invited sulfur companies to investigate the possibility of recovering free sulfur from the treating plant's hydrogen sulfide stream. Two companies, Southern Acid & Sulphur Co. and Texas Gulf Sulphur Co., responded and both, after much experimental work, reported the operation feasible.

Thus prepared, the two principal producers in the field, The Atlantic Refining Co. and The Carter Oil Co., jointly formed McKamie Gas Cleaning Co., a nonprofit organization, to construct and operate a 23,000,000-cu. ft. treating and natural-gasoline-extraction plant near the field (Fig. 1). This plant was completed in November 1943. A contract was made with Southern Acid & Sulphur Co., providing that company with all acid gas from the treating plant in return for a royalty of three-sixteenths of all sulfur recovered. The sulfur plant was placed in initial operation in early March 1944 (Figs. 2 and 3). Profiting from the experience gained in its pioneer work at McKamie, Southern later contracted for the acid gas flared at Arkansas Fuel Oil Co.'s Columbia plant and a year ago a second sulfur-recovery plant was placed in operation, returning a three-and-one-half-sixteenths royalty to that company for sulfur recovered from Dorcheat-Macedonia gas.

Sizable Reserves

As of January 1, 1947, gas reserves in place in these two reservoirs (McKamie-Patton and Dorcheat-Macedonia) were estimated to total over 700 billion cubic feet, including sulfur in the form of hydrogen sulfide estimated roughly at 1,980,000 tons. Progressive production methods under the sound conservation policy of the Arkansas Oil and Gas Commission indicate a high recovery figure for these reserves. The state has eliminated waste and assured total utilization of gas by allocating field production to correspond to input capacities of the natural-gas plants serving the two fields.

In the McKamie field gas is separated from oil and condensate in two stages and is gathered in high-pressure and intermediate-pressure networks. In addition, a third gathering system takes all tank vapors which contain high percentages of hydrogen sulfide and heavier hydrocarbons. These three streams enter the plant at 650, 40, and 2 psi. where the latter two streams are compressed to 650 psi. and combined flow of the three streams is charged to the gas-purification unit. Fig. 4 shows schematically the disposition of the sour gas at McKamie.

After contact with the monoethanolamine solution in the high-pressure absorber, the gas, stripped of hydrogen sulfide and carbon dioxide, passes to the conventional natural-gasoline plant where butanes and natural gasoline are extracted. After dehydration, the sweet residue gas is sold for industrial and domestic consumption in Arkansas.

The rich solution from the base of the absorber in the treating unit is flashed at 225° F. and 35 psi. in the reactivator where the acid gas is stripped overhead, cooled, and delivered to the sulfur plant. This plant employs a modified Klaus process incorporating a number of refinements on the old German process. Although operating details of this plant have not been made public, the schematic flow chart outlines the process in general.

In volume, the incoming acid gas stream varies from 2½ to 3 million cubic feet per day. After removal of water vapor in knockout drums equipped with cooling spray, the stream comprises on the average, 55 per cent H_2S, 43 per cent CO_2, and 2 per cent hydrocarbons carried over from the treating process. At about 10 psi. and 100° F. the acid-gas stream is mixed with air and partially burned in a specially designed furnace. The air-gas ratio is controlled to the amount required to burn all hydrocarbons and one-third of the hydrogen sulfide gas. Flue gas from the furnace then comprises carbon dioxide, and steam, together with roughly two parts of hydrogen sulfide to one part sulfur dioxide.

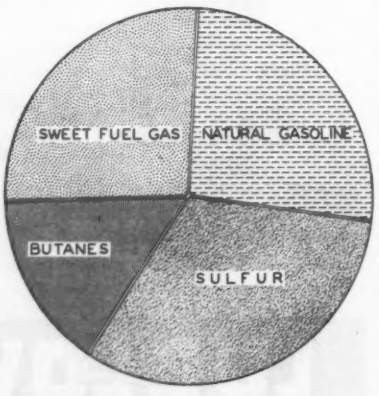

Fig. 5—Relative values of four products from McKamie gas at current prices and average production

Heat of combustion is utilized in generating steam supplied to both the sulfur plant and the natural-gasoline plant. Temperature of the mixed gases is further reduced and controlled at about 530° F. by heat exchange with boiler feed water. In the first-stage convertor, most of the sulfur compounds react in the presence of a bauxite catalyst to form water and free sulfur in a very finely divided, sublimated form. The basic equation for the reaction is

$$2\,H_2S + SO_2 = 2\,H_2O + 3\,S$$

In its method for recovering the sublimated sulfur, the company makes a successful departure from other processes. The gases and suspended sulfur pass to a packed column where they are scrubbed by a downward flow of liquid sulfur. On contact with the liquid, the sulfur particles become entrained and pass from the column base in liquid form. Sulfur compounds which did not combine in the first catalyst chamber pass overhead to a second convertor and packed column. The tail gas overhead from the second recovery column comprises mainly steam and carbon dioxide. From the accumulators at the base of each column, the sulfur is pumped to a rundown tank, maintained at 250° F. This vessel is used for measurement of production and the elemental sulfur in a high state of purity is pumped periodically to the storage pile where it is sprayed in thin layers and allowed to solidify.

Operational Problems

From this brief outline, the process appears to be simple and fairly trouble free, but such is not the case. Only by prolonged experience have chemists and engineers developed an uninterrupted operation which recovers on the average, better than 93 per cent of all intake sulfur. In the first place, the reactions in the catalyst chambers are not restricted to the simple one outlined above. This is shown by the presence of carbonyl sulfides in the tail gas. The exact nature of these additional reactions is not known, but is the subject of a current study.

Hydrocarbons in the incoming gas add complications. Since they require much greater air-gas ratios than hydrogen sulfide, slight variations in their percentage require relatively large corrections in the over-all air-gas ratio at the burner. The heat of combustion is also relatively high, requiring compensating heat loss to maintain correct temperatures in the convertor. In addition, partial combustion of such hydrocarbons results in caking of the catalyst beds with carbon black, a condition which must be prevented by providing proper air

ratios. Close cooperation between operators of the natural-gasoline and sulfur plants has eliminated much of the trouble occasioned by fluctuating volume and composition of the acid stream.

Sulfur itself shows peculiar properties which require careful temperature control. Its melting point is 239° F. but at 320° F. it becomes dark brown in color and very viscous, regaining its mobility at higher temperatures. Thus temperatures must be controlled within an 81° range to assure free operation of the liquid in packed towers and lines.

The air-gas ratio at the burners is adjusted by examination of the tail gases from the plant; an increase in hydrogen sulfide or sulfur dioxide requiring an increase or decrease of the ratio. Stabilization of volumes and composition of intake gas will eliminate most of the operational troubles and contribute to better over-all efficiency of recovery, as will installation of further temperature controllers and air ratio controllers which is contemplated.

Smaller Integrated Plants Practical

On the basis of experience gained in South Arkansas, sulfur recovery is considered practical from natural gases containing substantially less hydrogen sulfide. In such cases, maintenance of a separate plant would not be advisable since duplication of overhead in labor and plant facilities might offset the added income. A daily intake of the equivalent of about 30 tons of sulfur is estimated to be the break-even point for a separate plant, but economical sulfur recovery by this method is believed possible in units integrated into natural gasoline or desulfurizing plants, with recoveries as low as 2 or 3 tons of sulfur daily. This approximates 50 to 75 M.c.f. of pure hydrogen sulfide gas.

At present the two sulfur plants in Arkansas maintain their own labor forces, comprising a minimum of five men on operation and seven on yard work. The operation of integrated units could be maintained with substantially less additional labor and the need for full-time yard labor for dynamiting and loading could be eliminated entirely in small plants where shipments might require only a few days per year. The impractical method of handling solid sulfur in box cars promises to be supplanted by transportation in insulated tank cars of the type employed in shipping asphalt. Actual tests have shown this method practical.

In spite of the nature of the gases handled in these plants, corrosion of equipment is not a major problem. This is due to the very low pressures employed throughout the process. Low-pressure operation also minimizes the danger to personnel and adequate safety precautions are not difficult to maintain. Sulfur plants of this type are estimated to cost about $5,000 per ton per day capacity. The price of sulfur which has prevailed for many years is $16 per ton. This relationship indicates a reasonable amortization on such a plant.

A product survey on the entire operation at McKamie illustrates the importance of the sulfur operations there. It should be noted that this field produces excessively sour gas and its economics cannot be applied to other fields. Table 1 summarizes operations of the natural gasoline plant for 1946, with an estimate on sulfur produced. Using 1946 operations for an average, at current prices for products, an average value between 10 and 11 cents per M.c.f. of raw McKamie gas is realized on the combined operation. Fig. 5 illustrates the relative value on a total value basis.

TABLE 1—COMBINED McKAMIE PLANT OPERATIONS, 1946

Total gas intake, M.c.f.	9,455,839
Sweet gas sold, M.c.f.	7,153,728
Plant fuel, M.c.f.	755,934
Shrinkage, M.c.f.	1,514,731
Vented, M.c.f.	31,446
Butanes, bbl.	109,704
Natural gasoline, bbl.	153,345
Sulfur (est.), tons	22,000

Warren I. Allen, Stanolind Oil & Gas Co. junior engineer, has been transferred from Odessa, Tex., to the East Texas area, with headquarters at Greggton, Tex.

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Pipe-Line Problems

(Continued from page 61)

important because the effectiveness of pulling power under such conditions is much reduced as the tow line is lengthened.

Tow lines used for both tug boat and D-7 tractors, each with 55 drawbar horsepower were 1¼-in., 6 by 21, improved plow-steel cable. The four tractors worked in pairs connected by 60 ft. of cable passing through a snatch block hooked on a lug welded to the top of the pipe. Such lugs were installed at 600-ft. intervals along the section to facilitate moving the pipe. Seaward towing was done by a 1,400-hp. tug with twin-screw propellers which were important for maneuvering. Ample power was advantageous. The load pulled by the tug boat was calculated to be 42 tons but actual operations showed this to be more.

For securing the tow boat's tow line to the end of the 8,000-ft. section of 10-in. a unique method was adopted in order to avoid trouble which had frequently occurred at other big water jobs when lugs welded to the end of pipe (to hold such a line) have broken due to the strain.

The method devised by Britton consisted in having an open 4-in. nipple welded through the 10-in. pipe close to the bullplugged end. The tow cable from the tug was passed through this nipple; and after making two passes around the pipe it was passed back through the nipple; the end of the cable was secured alongside the tow cable by two wire-line clamps. After the 8,000-ft. section had been pulled to the buoy, the tow line was cut at the surface and the loose end dropped to the bottom. Another feature of pipe fabrication was the installation of a "Y" connection which will be described later in relation to the mooring buoy.

Since correct timing was essential to successful towing of an 8,000-ft. section, a "walky-talky" radio was used on shore to communicate through similar radio equipment on the tug. Flag signaling would have been used if the radio had failed. The railroad tracks were greased. Each of the two 8,000-ft., 10-in. sections was towed into its submarine position in 1 hour and 25-45 minutes.

After installing the first 8,000-ft. section in the water the 6,000-ft. tracks were torn down and rebuilt at a parallel location 200 ft. away within 3 days. The same operations were repeated for fabricating and installing the second 8,000-ft., 10-in. section. Under Indian conditions it took 4 days to fabricate an 8,000-ft. section. After this work was done, it was necessary to wait until the next high spring tide before towing seaward.

The "Y" connections previously referred to were made as follows: Near the end of each 8,000-ft., 10-in. line there was welded a 6-ft., 10-in. nipple at an angle of 45°, to which rotary drilling hose was attached after the 8,000-ft. sections were towed to the mooring buoy; during unloading a ship these two hoses were connected to the manifold on deck. When not in use, the hoses (with valves installed at the end) were dropped to the bottom; a cable known as a "pennant" connected each hose with a buoy float on the surface of the water. While each 8,000-ft. section was towed to position the "Y" nipple was closed by a blind flange.

With this type of mooring-buoy installation it was possible to eliminate having a barge anchored at the loading point which would have been objectionable because of the strong currents as well as for military security reasons.

Pumping facilities on shore were capable of unloading a 1,500,000-gal. gasoline cargo in 16 hours. The laying of these 10-in. mooring buoy lines made it possible to unload ocean tankers in deep water at all tides thus saving weeks of delay.

Coupling and Welding Construction

In the laying of the main 6-in. products line, exceptions were made in numerous cases from the general procedure of coupling the joints and laying the line on top of the ground. In the 555-mile Chilligong-Tunsuki section approximately 40 miles were welded. Welding was done at creek and river bottoms, sometimes at bends, and at other points. At each of the pump stations, 3,000 ft. of line was welded at the discharge side.

In addition to the welders trained by the army in the United States, the project used native welders trained in a 6-week course established by the construction organization.

Ditching

Ditching was frequently used to correct conditions occurring mostly at side bends and over bends of coupled lines laid on top of the ground where expansion would sometimes lead to kinking, also referred to as "gathering ahead," "wadding up," or "swarming." Ditches of ordinary depths of 18 in. were sufficiently effective for the purpose of safeguarding against such trouble. There was no advantage in trenching to greater depths.

Ditching machines did not arrive until the project was half completed. And they were not used because of the impracticability of making provisions for clearing right-of-way, etc., necessary for using them.

Ditches were dug mostly by hand. A good working coolie, known as a "wag," with a customary primitive type of hoe, known as a "kadilly," could dig an 18 by 18-in. ditch at the rate of 30 ft. per day.

Much ditch was dug by an unusual

type of plow, known as a "500-wag" plow, which was designed and built on the job by the construction organization. This plow was pulled by two D-8 tractors, each having 60 drawbar horsepower.

The effectiveness of this equipment is indicated by the fact that it was used in connection with ditching and laying 100 miles of welded line in 3 weeks.

Among approximately 700 Americans engaged in construction in the sections of the project discussed here, there were only 50 who had previous oil-field experience. Much credit is given to the five drillers serving as company commanders because of the ingenuity and persistence with which they steadily produced results with a lack of modern equipment of types currently used in pipe lines in American construction. Since tractors all arrived without booms, it was necessary to improvise side-boom equipment.

The pipe line was in operation for 3 months before telephone and teletype communication was established. Patrolling was not done from the air but by men on foot, riding elephants, or in boats.

The key to success for operating in this tropical country came through understanding the importance of utilizing large gangs of cheap native labor, hired at 45 cents (U.S.) per day (1½ rupees). American personnel was used finally only for supervision and inspection. With three American companies of 232 men each, a total of 3,000 natives were employed. With such coolie help a company would lay at the rate of 5 to 6 miles per day. Hand work progressed across rivers and swamps where modern machinery would have been difficult to manipulate and more expensive to operate.

Experience showed that often considerable experimenting and ingenuity was entailed in reaching simple solutions for numerous problems of reducing time and expense of construction which would have been handled differently by current methods used in the United States.

Texas Co. Establishing Fellowship at Purdue

The Texas Co. is establishing an industrial fellowship at Purdue University for study of mass transfer and heat transfer in refining and chemical processes, according to Dr. G. Stanley Meikle, director of Purdue's Research Foundation.

The fellowship results from the growing importance of processes in which reactants in the gas phase are contacted with a solid catalyst and the need for basic data necessary for the design of equipment for these processes.

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Centrifugal Compressors For Gas Pipe Lines

(Continued from page 69)

check valve or mechanically operated stop valve must be placed in the discharge line to prevent backward flow of the pipe line gas which would drive the blower backwards as a turbine at very high speed. A bypass arrangement would also be required to bring any unit "onto the line" in parallel with a unit already in service. (See Fig. 3.)

Centrifugal compressors should be started with a closed suction or discharge valve to reduce the starting load on the motor. The power input when operating at full speed and no delivery, is about 30 per cent of the full load power and the discharge pressure will be about 85 per cent of the maximum pressure at the pumping limit condition. This will normally be lower than the rated operating pressure, therefore, in paralleling a unit, the incoming machine must have a bypass connection to permit it to deliver at least 60 per cent of its capacity through the bypass valve. After the unit is up to speed, the bypass valve can be closed, whereupon the pressure will rise to the existing line pressure and the machine will come "on the line." The line characteristics should be carefully considered in the design to be certain that line pressures are such as to permit proper starting conditions.

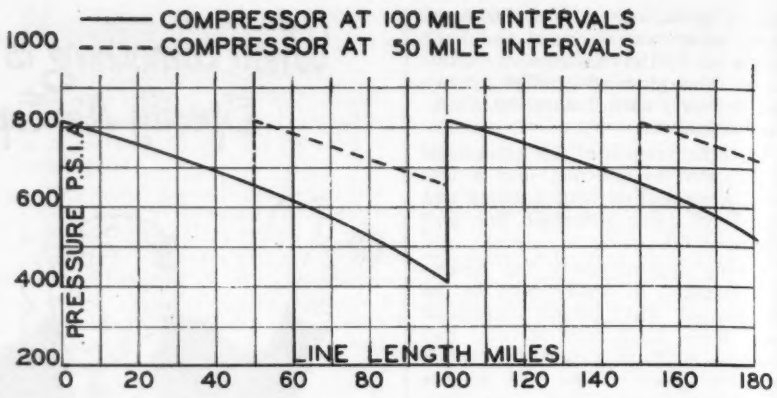

Fig. 10—Pressure along 24-in. pipe line at 265,000 cu. ft. per day of natural gas

To avoid an excessive temperature rise in the bypass gas, which would reduce the pressure rise in the machine, the piping (Fig. 3) is so arranged that the gas pumped through the starting machine is delivered to the suction line of the machine in operation. This will assure a constant supply of cool gas to the unit being started.

The steps required to bring the idle unit on the line would be as follows: (Refer to Fig. 3.)

A. Conditions at start.
1. Unit "A" operating.
2. Unit "B" idle.
3. Valves S and D open.
4. Check valve C open by gas flow.
5. All other valves closed.

B. Operational steps for bringing unit B on the line.
1. Open valves B′ and D′.
2. Start motor B (unit B).
3. Open valve S′.
4. Close valve B′. Units will now operate in parallel.
5. If necessary Unit A may be stopped. Check valve C will prevent any back flow after unit "A" has slowed down to the point where insufficient pressure is developed.
6. Valves S and D may be closed

A Quick Glance

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Cameron PRESSURE GAUGE

and unit A is ready to be serviced after blowing down.

If it is desired to have the two units on one station operate in series (in case the previous station is completely out) it can be accomplished by having the bypass lines made full size and the valves S and S′ (suction line valves) installed outside the bypass connection, as indicated by the dotted valves on Fig. 3. The operation (for unit "A" first stage and unit "B" second stage) would be as follows:

1. Valves S, D, B and D′ open.
2. Check valve C′ will be opened by gas flow.
3. Valves V, S′ and B′ closed.
4. Check valve C will be closed by gas pressure.

After the line is in full operation, the compressors should be self-regulating from somewhat over rated capacity to between 50 and 60 per cent of rated capacity. If the demand at the delivery end of the line decreases while the supply at the field end is maintained, the line pressure will rise slightly due to the shape of the characteristic pressure-volume curve, and the power for compression will be accordingly reduced. If the demand decreases below 60 per cent of the compressor capacity, the machine must be cut off or some of the previously discussed methods may be used to prevent pumping.

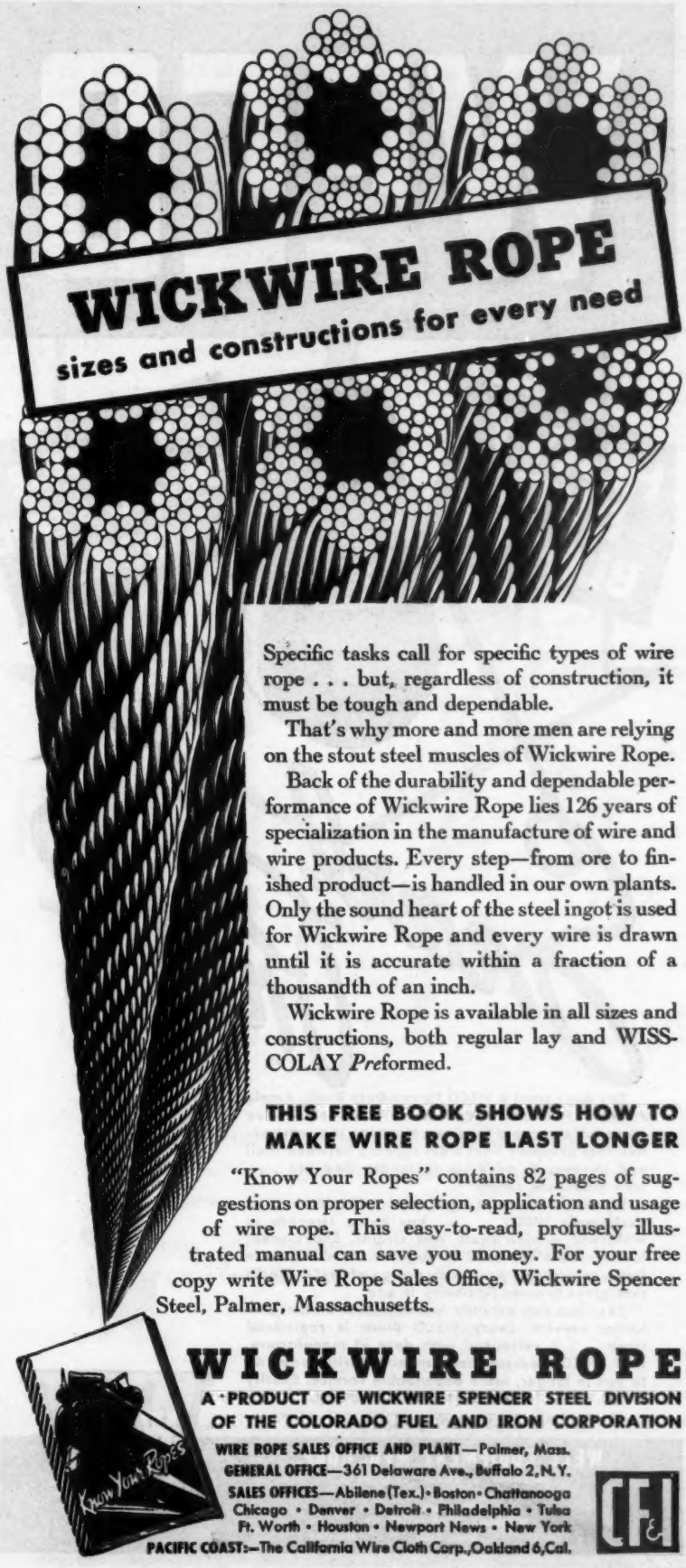
If the demand decreases but stays within the pumping limit of the machine, the control stations may be called upon for regulation to prevent a pressure surge from building up to a dangerously high level. This can be done by any capacity control provided or by cutting out the required percentage of stations at equal intervals.

Lubrication

Lubrication must be protected against interruption by any cause. This would require a positive circulating means for regular service plus an emergency storage device to supply oil to bearings and seals while emergency measures are being put into effect or the unit comes to a standstill. The form of lubrication facilities will vary with the type of installation, but should preferably include a lube-oil circulating pump driven from the main unit plus an electric-motor-driven standby or auxiliary and supplemented by the emergency storage apparatus referred to above. Means should be provided to keep the lubricating oil always under suction pressure or atmospheric pressure to avoid undue foaming due to absorption of gas being handled by the compressor.

Shaft Seals

The usual design for centrifugal compressors involves a shaft passing through both ends of the compressor cylinder, and obviously leakage must



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be prevented at these points. Some compressors are so arranged that the shaft passes through the cylinder at one end only. With the single-shaft seal and multistage design it is necessary to mount the bearings and the lubricating system inside the compressor casing under an ambient pressure substantially equal to the intake pressure of the unit. (See Fig. 4.) Many small compressors are built with a hermetically sealed motor or with the motor completely enclosed and operating in an atmosphere of the circulating medium and at the pressure of the gas being compressed, thus requiring no high pressure shaft seal. (See Fig. 5.)

The shaft seal is an absolutely vital part of the equipment and for the very high pressures involved is a very difficult engineering problem, since the rubbing speed of the shaft is far too high to permit the use of anything approaching the conventional stuffing box. The shaft seal has previously been a stumbling block in the application of centrifugal machines to this particular service. In our opinion the problem can be solved without the necessity of building complete full-scale compressors. A seal development program could be executed so as to arrive at the proper seal proportions for practical application, and this same program would serve to demonstrate the feasibility and reliability. Such a program of demonstration would be relatively simple in principle.

Starting Point

Perhaps the starting point should be a construction in which no seals, or at least very simple seals, are necessary. This would, obviously, indicate a motor and compressor completely enclosed in the pipe line and cooled by the gas stream passing the motor. (Fig. 5.) This could be varied by installing a seal on the shaft between the motor and the compressor, or designed into the compressor, and supplying a desirable gas (substantially equal to the suction pressure) to the motor compartment. This arrangement would make the pressure drop across the seal very low, making it mechanically an easier problem and the loss of gas (possibly hydrogen) could easily be kept at a minimum. The use of inert gas such as hydrogen would reduce the windage losses in the motor to a very considerable extent. From the electrical standpoint this seems to be practical as the insulation would not be adversely affected and cooling of the motor would be improved. The main difficulty would be accessibility for inspection and repair plus the compression and regulating equipment for the cooling of the inert gas. For this type of application a brushless motor (induction) is essential.

With the perfection of the seal to operate satisfactorily at a pressure

differential of 650 psi. a design such as indicated by Fig. 4 could be considered. This design would require the bearings to operate at suction-gas conditions. A possible danger would be the loss of oil to the gas stream. The service oil pump would be a standard lubricating oil pump supplying the oil only at a small pressure differential (10-20 psi.) required for positive bearing lubrication. This pump would be driven directly from the compressor shaft. In addition to this service pump, a scavenging pump would be required to pick up, at atmospheric pressure, all oil which leaks through the seal and deliver it to the oil sump which is at suction pressure (about 650 psia.).

If it is desired to keep the bearings in atmospheric air and one atmosphere pressure, this can be done with the use of two seals, one at each end of the compressor and inside of the bearings. This design will not require a scavenging oil pump but will require a pump to supply oil to the seals at a pressure slightly above suction pressure (650 psi.) at all times.

Materials of Construction

The standard materials used in commercial centrifugal compressors should be satisfactory for this service. These would comprise cast steel for the compressor cylinder, heat-treated alloy steel for the impellers or possibly straight 12½ per cent chromium steel if particularly corrosive conditions are encountered. Journal-bearing linings would be substantially pure tin babbitt with steel shells. Interstage labyrinth seals would be the 18-8 stainless steel now in use for this purpose.

Figs. 6 and 7 are views of typical casings which were designed for operating pressures up to 350 psi. Figs. 8 and 9 show some details of typical impeller construction.

Costs

All cost factors herein mentioned are estimates based upon the conversion of the Big Inch (24 in.) line to natural-gas transportation at a rated capacity of 265,000,000 cu. ft. per day and an average yearly load factor of 75 per cent.

For the gas-engine-driven reciprocating compressors the present state of the art would dictate the installation of a pumping station at intervals of 100 miles. This would require pumps for a compression ratio of 2 to 1—suction pressure 408 psia. and discharge pressure 815 psia., requiring about 12,000 hp. per 100 miles. The electric-motor-driven, centrifugal compressor at 50-mile intervals would operate at a compression ratio of 1.25 to 1—suction pressure 650 psia. and discharge pressure 815 psia. This would require about 3,500 hp. per station, or 7,000 hp. per 100 miles (See Fig. 10).

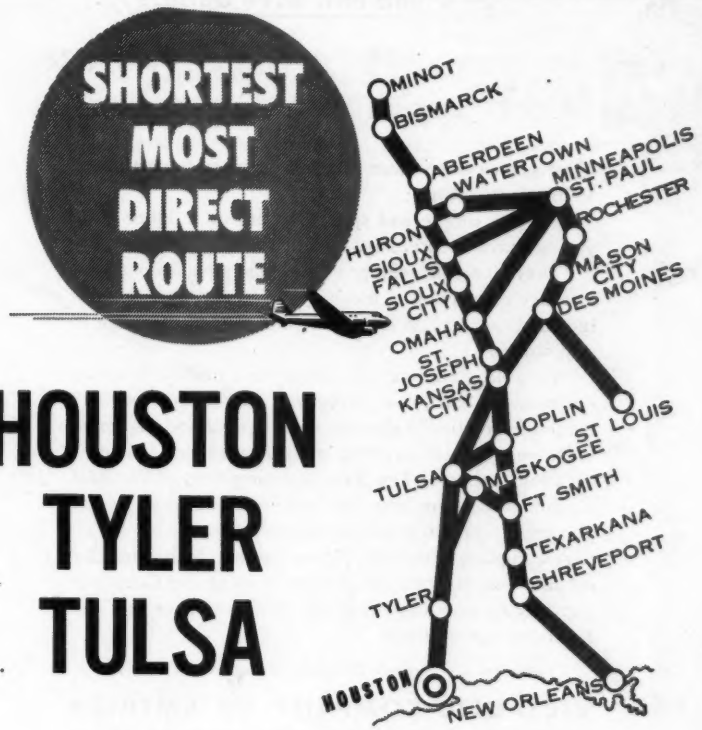
The cost of the gas-engine-driven reciprocating compressor station would be about 1.5 to 1.75 million dollars or that same amount per 100 miles of pipe. The cost of the centrifugal pumping station would be about 0.15 to 0.25 million dollars depending upon the reserve capacity provided in the installation. This would be 0.30 to 0.50 million dollars per 100 miles of pipe line. This type of installation is particularly feasible where the electric power lines are already available.

The operating costs for the above two types of installation would be comparable at 75 per cent average annual load. At lower load factors the electric-motor-driven centrifugal machines would prove more economical while at higher average annual load factors the gas-engine-driven reciprocating compressors would prove more economical in operation.

Due to the great reduction in equipment and material needed with the use of centrifugal machines the initial cost (where power is available) is considerably less than that required for reciprocating machines. At load factors which are in line with practical experience, the operating costs of the two types of installation are about equal.

Conclusions

This study is too limited to draw final conclusions; however, it does



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indicate that the further investigation of centrifugal compressors for the Big Inch line, if used for natural-gas transportation, is warranted. The required seal development program would be a good investment particularly in the face of recent experience with modern seal design.

A Linear Reservoir

(Continued from page 63)

to obtain the convergence of reserve. Let A equal the area of a reservoir at any elevation such as M. Let "a" be the area at an elevation B which is higher than the elevation M. Then the approximate convergence C is defined by:

$$C = \frac{2A}{A + a} \qquad (1)$$

where A is the productive area at the elevation M and "a" is the productive area at an elevation which is 1,000 ft. updip from M along the top of pay.

The C curve in Fig. 16-11 is a solution of Equation 1 for the L-1 reservoir. The convergence per 1,000-ft. updip intervals is plotted against position along the top of pay. The convergence for 1,000 ft. updip from the water contact, zero position, is 1.04. The convergence at the 7,000-ft. position is 1.07 for 1,000 ft. updip from the 7,000-ft. position. Along the updip productive limit, productive area "a" is equal to zero and the convergence is equal to 2.

Reference

1. "Stratigraphic-Type Oil Fields," a symposium, A.A.P.G., Tulsa, 1941.

BOOKS

MEN, OIL, AND WAR. By D. Thomas Curtin. Published by Petroleum Industry Committee. 360 pp.

This volume tells the story of the work oil men of the Midwest did to help win the war. The book originated with a request from the Government for a report which might serve as a guide in any future emergency and cut short the time needed to organize the production and supplying of oil products. The writing task was turned over to an experienced author. Out of his work and the cooperation of members of the committee has now emerged a graphic description of the performance by the oil fraternity in 15 midwestern states in furnishing petroleum products to the armed forces and keeping the essential civilian needs supplied.

How pipe lines, rail tank cars, Great Lakes tankers, river barges, and tank trucks were used to their maximum capacity, how refineries were adjusted to war requirements, and how many diverse interests and personalities were united in what became a smoothly operating part of the war machine is told in this latest of the postwar publications for purposes of "the record."

Copies of the book are to be distributed to committee members, the press, libraries, oil-industry leaders, and representatives of federal and state governments, according to O. D. Donnell, who served as chairman of the industry's general committee for District 2.

MODERN Rotary DRILLING

Non-A.P.I. Substructures

TO provide more working room under the derrick floor and give the height and capacity required by modern drilling operations, a number of manufacturers are now building substructures which differ in construction, details, and specifications from those made according to A.P.I. standards.

Fig. 8 shows one of such substructures. It is one of the truss type with all the interior loads transmitted directly to the four corners of the substructure. This eliminates the need for the rotary support columns, provided for by the A.P.I. specifications. Use of this type of substructure is of particular advantage on locations requiring piling for foundations since the need is eliminated for pile clusters under these columns. The design is such that the pipe may be racked either in front of the draw works or in front of the driller.

The substructure of this type, used by one of large operators, with 30-ft.-base derrick, has following specifications: height 10 ft., carrying load of 1,500,000 lb. at the corners, casing load of 600,000 lb., drill-pipe setback load of 300,000 lb. Weight of the substructure is 54,000 lb.

Fig. 9 shows another substructure of similar type. All loads are carried to the side and corner column supports, leaving ample clearance and working room under the derrick floor. The construction is such that the supports are on the draw works and window side leaving tool ramp and ladder sides open. This facilitates access to the wellhead connections and makes the substructure especially well adapted to skidding. The substructure is manufactured in heights of 10 ft., 12 ft., and 14 ft. 6 in. The corner column capacity ranges from 1,000,000 to 1,400,000 lb., casing capacity from 300,000 to 450,000 lb., and drill-pipe capacity from 150,000 to 200,000 lb.

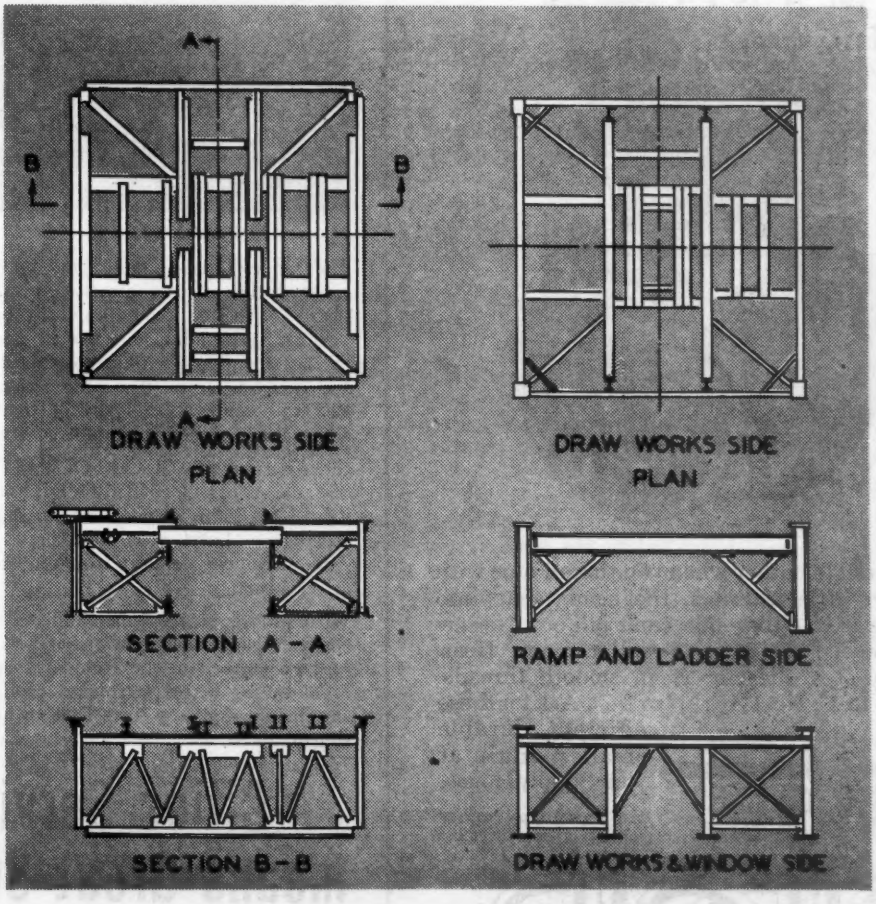

Fig. 8—Truss-type substructure

Fig. 9—Open ramp-and-ladder-sides-type substructure

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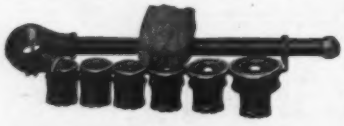

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ENGINEERING fundamentals

Computations of Plunger Travel

PART 2

Rieniets Method

THE equation proposed by R. W. Rieniets[1] is as follows:

$$S_p = S_r \cos\theta + 2\left(\frac{Q\beta}{K}\right) - 2\left(\frac{W_f}{K}\right) - \frac{F}{K} \quad (1)$$

where

S_p = stroke of plunger, in.

S_r = stroke of polished rod, in.

W_f = weight of fluid supported on plunger, lb.

θ = phase angle or angular lag of crank arm at upper and lower positions behind like movement of plunger, deg.

β = Beta, magnification factor, a factor which must be introduced wherever sudden and periodic loads are applied to any spring system = ratio of dynamic to static deflection.

K = spring constant, pounds required to produce a stretch of 1 in. in the rods.

F = friction, lb.

Computations.—The solution of the problems of this character is facilitated if the order suggested by Rieniets is followed, thus:

(1) W_f, Weight of the fluid
(2) W_r, Weight of rods
(3) C, Acceleration factor
(4) Q, Disturbing factor
(5) F, Rod and tubing friction
(6) K, Spring constant of rods
(7) T_n, Period of natural frequency of rods
(8) T_f, Period of forced or impressed frequency of rods
(9) R, Ratio of 7 to 8
(10) β, Magnification factor
(11) θ, Phase angle

Problem:

Compute the net stroke of the plunger for the following well data:

Depth of well = 5,465 ft.
Length of rods = 4,050 ft. of ¾-in. rods + 1,400 ft. of ⅞-in. rods
Tubing = 5,200 ft. of 3-in. + 265 ft. of 2.5-in.
Plunger = 2 in. x 1¾ in.
Wt. of rods per ft. = 1.63 lb. for ¾ in.
Wt. of rods per ft. = 2.26 lb. for ⅞ in.
L = Length of polished-rod stroke, in. = 44.6
N = s.p.m. = 21.2.

Solution:

(1) W_f, weight of fluid
= net plunger area, × depth in ft. × weight of fluid per ft. per sq. in.
= (2.403 — .441) 5,450 × .401
= 4,287 lb.

(2) W_r, Weight of rods
= 4,050 × 1.63 + 1,400 × 2.23
= 9,765 lb.

(3) C, Acceleration factor
= (Angular velocity of crank arm)² × $S_r/2g$

$$= \frac{4\,pi^2 \times 21.2^2}{3{,}600} \times \frac{44.6}{2 \times 32.2 \times 12}$$

= .284

(4) Q, Disturbing force
= $W_f(1 + C) + 2 W_r C$
= 4,287 × 1.284 + 2 × 9,765 × .284
= 11,050 lb.

(5) F, Rod and tubing friction can be found by taking a dynamometer reading at such slow speeds that the acceleration forces may be ignored. The differential load as shown on the card repre-

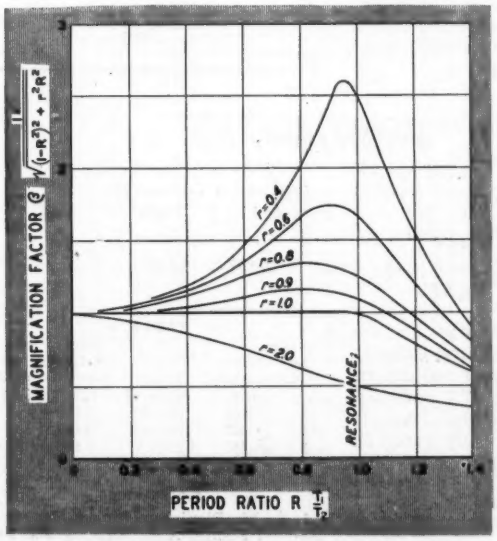

Fig. 1—Magnification factor and period ratio for different values of damping (from "Plunger Travel of Oil-Well Pumps"—R. W. Rieniets, A.P.I. Drilling and Production Practice 1937)

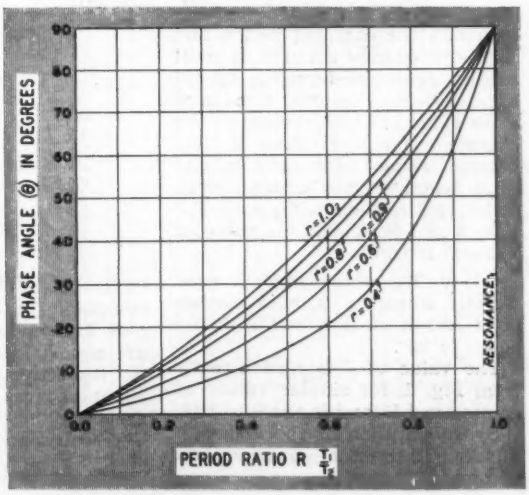

Fig. 2—Phase angle and period ratio for different values of damping (from "Plunger Travel of Oil-Well Pumps"—R. W. Rieniets, A.P.I. Drilling and Production Practice 1937)

Series prepared by Dr. E. A. Stephenson, head of petroleum engineering school, University of Kansas

sents the weight of the fluid plus twice the rod friction. It is not commonly measured, even though the procedure is simple, provided the equipment is available. It may be estimated at approximately ¼ lb. per ft. of depth, thus 5,465 × .26 = 1,388 lb.

(6) K, spring constant

$$= \frac{\text{Young's Modulus E}}{\left(\frac{L_1}{A_1} + \frac{L_2}{A_2}\right) 12}$$

where

$E = 30 \times 10^6$

L_1 = Length of ¾-in. rods

L_2 = Length of ⅞-in. rods

A_1 = Cross-sectional area of ¾-in. rods

A_2 = Cross-sectional area of ⅞-in. rods

$$\therefore K = \frac{30 \times 10^6}{\left(\frac{4{,}050}{.441} + \frac{1{,}400}{.601}\right) 12}$$

(7) T_s, period of natural frequency of the rods

$$= \frac{\text{four times rod length}}{\text{velocity of sound in steel}}$$

$$= \frac{4 \times 5{,}450}{17{,}000} = 1.28 \text{ seconds.}$$

(8) T_f, Period of forced vibration of rods

$$= \frac{\text{seconds per minute}}{\text{strokes per minute}}$$

= 2.8 seconds.

(9) R, Ratio of 7 to 8

= 1.28/2.8 = .458

(10) β (Beta), The magnification factor is dependent on both γ (gamma), the damping factor, and R, the frequency ratio; it is most readily determined by the use of Fig. 1. Rieniets assumes a value of .8 for gamma, which represents the composite damping effects of fluid friction, friction between metal and fluid, together with tubing stretch or internal friction of the rods. For $\gamma = .8$ and R = .458, the value of β (Beta) is 1.15.

(11) θ, The phase angle is read directly from Fig. 2, with gamma of .8 and R of .458, and is found equal to 25°.

The value of β is read directly from Fig. 2, for similar values of gamma and R, and is equal to 1.15.

By substitution of the above in Equation 1, the final equation then becomes:

$$S_p = 44.6'' \times \cos 25° + \frac{11{,}050 \times 1.15}{217} - \frac{2 \times 4{,}287}{217} - \frac{1{,}388}{217} \quad (2)$$

$$= 40.4'' + 58.5'' - 39.5'' - 6.4'' = 53''$$

In the preceding equations by Rieniets assumptions as to the value of friction, and the damping factor are made, and it is further assumed that the tubing is anchored, while in the Marsh-Coberly equation the computations assume that the tubing is free and stretches and retracts alternately as the weight of the fluid shifts from standing valve to plunger.

Another formula for the computation of plunger stroke has been proposed by Langer and Lamberger.[2] In its simplified form:

$$\text{E.P.S.} = \frac{S}{\cos(.0004\, L\, N)^\circ} - \frac{W_{oD}\, L}{2 \times 10^6}\left(\frac{1}{A_r} + \frac{1}{A_t}\right) \quad (3)$$

where

E.P.S. = Effective plunger stroke

S = Polished-rod stroke

W_{oD} = Differential fluid load on plunger, or weight of net fluid head on full area of plunger

L = Length of sucker rods in ft.

N = Number of strokes per minute

A_r = Cross-sectional area of rods

A_t = Cross-sectional area of steel in tubing

Where the fluid level is at the same position as the pump, the terms $W_{oD}L$ may also be expressed as the product of the plunger area, sq. in., times the pressure in pounds per sq. in., per foot of fluid column, multiplied by L.[2]

If the same problem be used at this point as was used in the preceding computations for plunger stroke by the Rieniets equation, the effective plunger stroke is as follows:

$$\text{E.P.S.} = \frac{44.6}{\cos(.0004 \times 5{,}450 \times 21.2)^\circ} - \frac{.401 \times 2.403 \times 5{,}450^2}{2 \times 10^6}\left(\frac{1}{.482} + \frac{1}{2.425}\right) \quad (4)$$

$$= \frac{44.6}{\cos 46.2^\circ} - 14.32 \times 2.487 = 28.8''$$

The length of the plunger strokes computed by the Marsh-Coberly and Langer-Lamberger equations are almost identical, 27.7 and 28.8 in. respectively, but the Rieniets equation gives practically twice as great a plunger stroke, 53 in. The differences are due in part to the use of the tubing stretch by the two groups of authors while this factor is ignored in the Rieniets equation which considers the tubing anchored. The Rieniets equation calls for very large values of the over-travel, due both to acceleration and the magnification factor, with the latter dependent greatly on the assumed value of the damping factor, gamma. The latter should be determined experimentally from surface dynagraph cards, by measurement of the natural period of vibration of the sucker-rods with such damping as actually occurs during the pumping cycle. Gamma may then be computed by means of the following equation:

$$\text{Gamma} = 2\sqrt{1 - (T_1/T_2)^2} \quad (5)$$

where

T_1 = period of natural vibration without damping

T_2 = period of natural vibration with damping (measured by means of surface dynagraph cards)

Lacking such experimental data the following table has been prepared to show the computed plunger strokes with various assumed values for the damping factor γ, gamma. The phase angle was computed as follows:

$$\theta = \frac{\gamma R}{1 - R^2} \quad (6)$$

where θ is the phase angle and R is the ratio of natural period of vibrations to impressed period of vibrations.

The magnification factor is calculated thus:

$$\beta = \frac{1}{\sqrt{(1 - R^2) + \gamma^2 R^2}} \quad (7)$$

TABLE 1

Damping factor γ	Frequency ratio, R	Phase angle, θ	Magnification factor, β	Plunger stroke, in.
1	.457	30° 2″	1.092	48.1
1.2	.457	34°48″	1.04	44.4
1.4	.457	39°	.983	39.6
1.6	.457	42°46″	.929	34.9

References

1. R. W. Rieniets, Plunger Travel of Oil-Well Pumps, A.P.I. Drilling and Production Practice, 1937, pp. 159-178.

2. B. F. Langer and E. H. Lamberger, Calculation of Load and Stroke in Oil-Well Pumping Rods, The Oil and Gas Journal, Vol. 41, No. 8-9, July 2, pp. 27-32; July 9, pp. 26-32, 1942.

The Refiner's Notebook

A WEEKLY FEATURE OF THE OIL AND GAS JOURNAL

Transfer-Line Vaporization

CONDITIONS

1. Refer to The Refiner's Notebook No. 128, January 25, for temperature drop in transfer line; and Notebook No. 132, February 22, for pressure drop.
2. Throughput is based on cold velocity (60° F.) in line.
3. Use equivalent length of transfer line.
4. Prepared for atmospheric towers at 1-15 psig. but probably reasonably accurate up to 60 psig.
5. Stock A has true boiling point slope of 4.0, and Stock B a slope of 7.0.
6. Use—Estimate vaporization in tower, compute cold velocity, compute equivalent length of line, and read per cent vaporization that occurs in transfer line.
7. Vaporization at pipe-still outlet equals tower vaporization less the vaporization occurring in line.

APPROXIMATE PER CENT VAPORIZATION OCCURRING IN TRANSFER LINE

Equivalent length of transfer line—ft.	Kind of stock	20% VAPORIZED IN TOWER —Cold Vel. (60° F.) IN LINE—ft./sec.— 2	3	4	5	6	7	8	40% VAPORIZED IN TOWER —Cold Vel. (60° F.) IN LINE—ft./sec.— 2	3	4	5	6	7	8
20	A	...	...	...	...	...	...	2.0	...	...	...	...	3.0	6.0	8.2
	B	...	...	...	...	...	...	2.0	...	...	...	...	3.0	6.5	9.4
40	A	...	...	...	...	2.6	5.4	8.2	...	...	3.0	5.9	8.8	11.4	13.0
	B	...	...	...	...	2.6	6.5	9.7	...	...	3.0	7.6	11.4	14.8	17.9
60	A	...	...	0.5	3.2	6.5	9.2	11.5	...	1.2	5.9	9.4	11.9	14.2	16.2
	B	...	...	0.5	4.2	7.6	11.0	13.6	...	1.2	6.5	11.4	16.1	19.2	21.5
80	A	...	...	1.6	5.9	9.2	12.0	13.6	...	2.3	8.2	11.4	13.7	15.5	17.3
	B	...	...	1.6	7.0	11.0	13.6	15.3	...	3.0	9.4	14.8	19.2	21.6	23.3
100	A	...	...	3.2	7.6	11.0	13.1	14.8	...	6.5	10.0	13.0	15.5	17.3	18.5
	B	...	...	3.7	9.2	13.1	15.9	17.5	...	8.2	13.6	17.3	21.0	23.4	25.0
150	A	...	3.2	7.6	11.5	14.2	16.4	...	1.7	8.2	12.5	15.5	17.9	19.7	21.0
	B	...	3.7	8.6	12.6	15.9	18.5	...	1.7	10.7	17.3	21.0	23.3	25.7	27.5
200	A	0.5	6.0	10.4	13.1	15.3	17.5	...	4.0	10.7	14.9	17.9	19.7	21.0	...
	B	0.5	0.7	12.0	14.7	17.5	19.6	...	4.6	13.7	19.7	23.3	25.0	26.9	...

Equivalent length of transfer line—ft.	Kind of stock	60% VAPORIZED IN TOWER							80% VAPORIZED IN TOWER						
10	A	...	...	...	...	...	...	3.8	...	...	...	0.7	2.0	4.1	7.6
	B	...	...	...	...	...	...	3.8	...	...	...	0.7	2.0	4.8	8.2
20	A	...	...	...	...	5.0	8.2	11.5	...	...	2.0	5.5	8.9	11.7	13.8
	B	...	...	...	0.6	5.8	10.9	14.7	...	0.7	2.0	6.9	11.0	14.5	17.9
40	A	...	...	5.0	8.8	12.1	14.6	16.5	...	...	7.6	11.7	14.4	16.5	17.9
	B	...	0.6	6.4	11.5	15.9	19.1	22.4	...	0.7	8.9	15.1	19.9	23.3	26.1
60	A	...	...	8.8	12.1	15.2	17.2	19.7	0.7	7.6	11.7	14.4	17.2	19.3	20.6
	B	...	3.8	10.9	15.2	19.7	23.0	26.1	0.7	9.6	15.9	20.6	24.0	27.5	30.1
80	A	0.6	6.4	10.9	14.0	17.2	19.6	22.4	1.5	8.9	13.8	16.5	18.6	20.6	22.0
	B	0.6	8.3	14.0	18.5	22.4	25.5	28.7	1.5	11.7	18.6	22.7	26.1	29.5	32.2
100	A	1.2	8.3	12.8	15.9	19.1	21.7	23.6	2.8	11.0	15.1	17.9	19.9	22.1	23.3
	B	1.2	10.1	15.6	21.0	24.2	28.0	30.6	3.5	13.8	20.6	24.7	28.1	30.8	33.6
150	A	3.8	10.9	15.9	19.1	21.7	24.2	25.5	6.9	13.8	17.9	19.3	22.1	23.3	...
	B	3.8	13.4	19.7	23.6	26.8	29.3	31.8	7.5	18.6	24.7	26.8	30.8	32.9	...
200	A	6.4	13.4	17.8	21.0	23.0	25.5	27.5	9.6	15.1	19.3	21.3	23.3	24.7	...
	B	8.2	16.6	22.3	26.1	28.6	30.6	33.5	11.7	21.3	27.5	30.9	32.9	34.2	...

No. 134 in α series by W. L. Nelson, professor of petroleum refinery engineering, University of Tulsa

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PIPE LINES

Phillips Mixes Crude With Gasoline in Line to Borger

Phillips Petroleum Co. is moving 5,500 bbl. daily of crude oil in the stream of gasoline-plant products being shipped through its Mextex 8-in. line from West Texas to the company's refinery at Borger, Tex.

Most of this crude is reported to be coming from the Embar area. The total amount of crude shipped in this way will be increased by additional crude from the Fullerton area which will raise the total to 8,500 bbl. daily after five temporary pumping units have been installed within 60 days. These will be centrifugal pump units: two electric driven with speed increasers at Fullerton; three direct connected to butane engines at Olton, Tex.

In addition to the 8,500-bbl. crude-oil shipments, an equal amount of gasoline-plant products will be mixed in a common stream without batching. Separation will be done at the Borger refinery.

Plans for a 289-mile, 12-in. pipe line are reported to be considered by Phillips, but it has not yet been possible to make definite preparations.

Standish Pipe Line Co., a Phillips affiliate, has contracted with Cheek Construction Co. to replace 6 miles of 10-in. near Sharpe, Kans.; work is now going on. Vaughn & Taylor Construction Co. is starting to lay 9 miles of 8-in. loops along the Phillips products line near Wichita, Kans. Work is about one-third completed on the reconditioning of 65 miles of 8-in. Phillips products line in Kansas contracted by H. C. Price Co. and Bishop & Locke Construction Co.

Contracts Awarded for Trans-Arabian Project

Trans-Arabian Pipe Line Co. has announced details of arrangements for contracts for construction of the 1,100-mile Persian Gulf-Mediterranean crude-oil pipe line.

Williams Brothers Corp. will construct 450 miles of main line at the western end and also the Mediterranean tanker loading terminal. Bechtel Brothers and associates, including H. C. Price Co., will lay 600 miles of main line and build four pump stations at the eastern end.

Orders have been placed with Consolidated Steel Corp. for 980 miles of pipe and with National Tube Co. for 70 miles. Tanks with an average total capacity of 5,700,000 bbl. will be built as follows: Chicago Bridge & Iron Co., 14 tanks; Graver Tank & Manufacturing Co., 22 tanks. Graver will also build two intermediate pump stations at the western end.

Laying of pipe is expected to start early in 1948, according to reports

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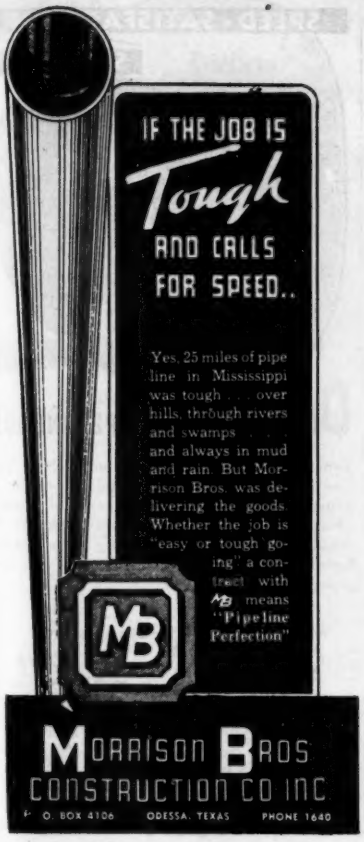
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from a party of construction executives headed by S. D. Bechtel, recently in Cairo, Egypt, en route to look over the ground in Arabia.

David R. Williams and Guy S. Connors, vice presidents of Williams Brothers Corp., will leave New York on March 7 for a reconnaissance trip over the route of the Trans-Arabian project.

Regarding the amount of 30 and 31-in. pipe which will be fabricated and other details, U. S. Steel Corp. reports that Trans-Arabian's engineers have not yet decided on the exact specifications.

Location of western terminus of the line has not yet been announced. The eastern terminus presumably will be adjacent to Saudi Arabia's Dammam field, which lies northeast of Abqaiq, the latter being a field where Arabian American Oil Co. believes the probable reserves are in excess of 4,000,000,000 bbl. Both Trans-Arabian and Arabian American companies are jointly owned by Standard Oil Co. of California and The Texas Co.

Completion of the Trans-Arabian pipe line has been tentatively set for early 1950.

Standard of Indiana Fills Minnesota Line

Standard Oil Co. (Ind.) has completed the 662-mile 10-in. pipe line for delivering products from the company's Whiting, Ind., refinery via Joliet, Ill., to Minnesota and Dakota terminals.

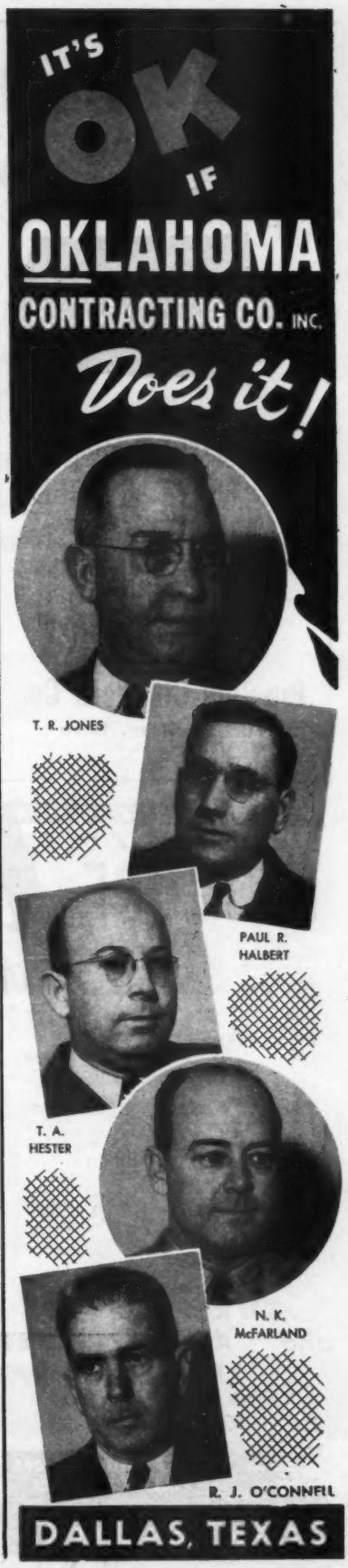
Early this week the line had been filled as far as Joliet, Ill. Filling operations will continue during the week so that deliveries may be made soon from the most distant terminals on the system at Moorhead, Minn., and Fargo, N. D.

Industry Increasing Gas-Line Capacities

In planning to meet the large demand for natural gas next winter, consideration is being given increasing the efficiency of present lines as well as to addition of loops and compressors.

One company has increased gas transmission throughput by 10,000,000 cu. ft. daily through more effective scraping with pigs run through the lines. Data of this company indicate that thorough removal of hydrates and other material means that less material will be deposited in the course of line operation. It was found that a dirty line will accumulate more dirt and decrease inefficiency while a clean line will not only remain clean but even increase in efficiency.

Studies are being made by other organizations of the possibilities of



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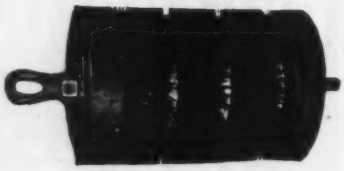

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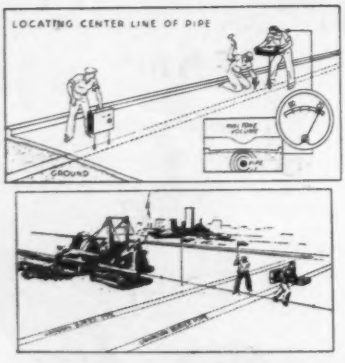

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Empire Pipeline Participates In 500-Mile Westex Outlet

Empire Pipeline Co. will participate in the 500-mile crude-oil line for shipping West Texas and New Mexican crude via Jal, N. M., to Cushing, Okla. In this project Empire Pipeline will have a 13⅜ per cent interest. The other two companies are The Texas Pipe Line Co. 53 per cent; Shell Pipe Line Corp. 33⅓ per cent. (The Oil and Gas Journal, March 1, page 51).

Specifications are not expected to be issued before the middle of the summer; construction is not likely to start before the fall.

Radio Service for Pipe Lines Is Planned

Plans have been made by a special oil-industry radio committee to push proposals by Joseph Keller, National Petroleum Association, for special petroleum radio service for communication along rights-of-way of petroleum pipe lines.

At a committee special meeting, under the chairmanship of James E. Moss, director of transportation, American Petroleum Institute, it was decided to recommend to the A.P.I. that a central permanent committee on radio petroleum facilities be set up and that clearance of activities be made through the transportation division.

The recommendations will be presented to the general transportation committee for a letter ballot, prior to the A.P.I. board of directors meeting April 23 in Washington.

Those participating in the conference in addition to Keller and Moss included Harry L. Cornell, marine department, Standard Oil Co. of New Jersey, New York A. H. Riney, Phillips Petroleum Co., Bartlesville, Okla.; F. W. Littell, Shell Pipe Line Corp., Houston; and C. B. Lester, Sohio Pipe Line Co., St. Louis.

Texas Commission to Hear Rate-Increase Application

The application of Cardinal Pipe Line Corp. for an increase in pipe-line loading and handling charges for oil handled and run through its line from Jacob field, McMullen County, Texas, to its loading rack at Whitsett, Tex., will be heard by the Texas Railroad Commission March 11 in Austin.

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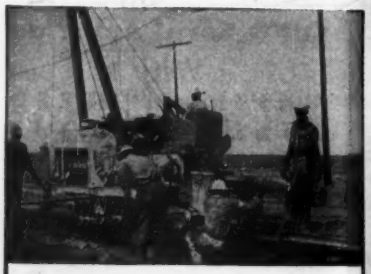

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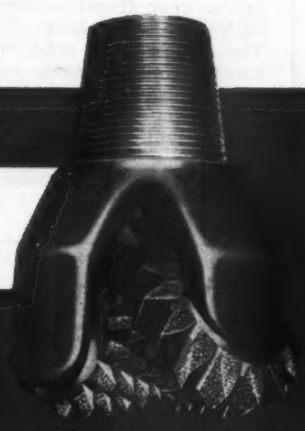

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REFINING

A.P.I. Refining Division Plans Midyear Meeting

A 2-day midyear meeting of the refining division of the American Petroleum Institute will be held in St. Louis, June 2 and 3, Dr. Robert E. Wilson, vice president for refining, announced early this week.

Headquarters of the meeting will be in the Jefferson Hotel. Wilson said the meeting will feature technical sessions on refining processes and problems and an open dinner meeting will highlight the program June 2. The preliminary program for the meeting, he said, will be announced in the near future.

Requests for hotel accommodations will be handled by the St. Louis convention and publicity bureau, 911 Locust St., St. Louis 1.

Sid Richardson Refining Completes Organization

The organization of the Sid Richardson Refining Co. has been completed, and its headquarters are now located in the Wilson Building, Dallas.

The company recently purchased the Texas City, Tex., refinery of American Liberty Oil Co. Freeman W. Burford, who has been connected with Mid-Continent refinery operations for many years, is president of the new company.

It was announced the Richardson company assumed ownership of the Texas City refinery March 1. A contract for renovation and remodeling of the refinery has been awarded, and the new company plans to start operations April 1.

Complete W.P.R.A. Program Announced

PETROLEUM chemicals, the supply-and-demand picture, and synthetic-fuel production are among the subjects which will receive emphasis at the thirty-fifth annual meeting of the Western Petroleum Refiners Association March 24 in the Plaza Hotel in San Antonio.

Technical sessions have been arranged to fill the mornings of March 25 and 26, with general sessions scheduled for the afternoons. Opening day of the meeting will be devoted to committee meetings and registration.

New officers and directors will be elected during the general session on the second day.

Hotel accommodations may be obtained by contacting C. C. Patterson, San Antonio Chamber of Commerce.

The tentative program follows:

MONDAY, MARCH 24

2:30 p.m.—Motor Fuel, Tractor Fuel, and Diesel Fuel Committees (joint meeting).

4:30 p.m.—Finance Committee meeting.

6:30-11.00 p.m.—Buffet supper (informal), compliments of the Ethyl Corp.

TUESDAY, MARCH 25

9:30 a.m., Technical Session.—L. D. Mann, Cities Service Refining Corp., Lake Charles, La., presiding. "Motor Fuel Trends in Relation to Antiknock Requirements," T. H. Risk, Ethyl Corp., Detroit. Catalytic-cracking panel discussion. (Discussion from the floor will follow each paper).

2:00 p.m., General Session.—R. L. Tollett, Cosden Petroleum Corp., Big Spring, Tex., presiding. Address of welcome, Gov. B. H. Jester; opening remarks, H. T. Ashton, W.P.R.A. president; nominating-committee report; "Petroleum and Natural Gas—Uses and Possible Replacements," R. E. Wilson and J. K. Roberts, Standard Oil Co. (Ind.); "Fueling the Navy," Capt. Ralph E. Wilson, U.S.N.; election of board of directors and officers.

6:30-11.00 p.m.—Dinner and annual spring fiesta party, compliments of supply and transportation companies serving the refining industry. (Informal).

WEDNESDAY, MARCH 26

9:30 a.m., Technical Session.—G. R. Kinter, Tide Water Associated Oil Co., Tulsa, presiding. "Petroleum Chemicals," Col. M. B. Chittick, Pure Oil Co., Chicago; "Synthetic-Fuel Production by the Hydrocol Process," P. C. Keith, Hydrocarbon Research, Inc., New York. (Discussion from the floor will follow each paper).

10:00 a.m.—Meeting of W.P.R.A. board of directors.

12:30 p.m.—Luncheon.

2:00 p.m., General Session.—R. W. McDowell, Mid-Continent Petroleum Corp., Tulsa, presiding. "Various Factors in the Future Supply and Demand Picture," S. A. Swensrud, Standard Oil Co. (Ohio), Cleveland; "Petroleum Industry Public-Relations Program," Ralph C. Champlin, Ethyl Corp., New York.

7:00 p.m.—Annual dinner dance (informal).

Socony-Vacuum Making Changes at East Chicago

Work has begun on the change of catalyst and case repair on the four-case Houdry fixed-bed catalytic-cracking unit at Socony-Vacuum's East Chicago, Ind., refinery of Socony-Vacuum Oil Co., Inc.

Contract for the work has been awarded to Catalytic Construction Co., Philadelphia, which will complete similar work at Socony-Vacuum's Paulsboro, N. J., plant, approximately March 15. Charging capacity of the East Chicago refinery is 34,500 bbl. daily crude and 20,500 bbl. daily cracking; capacity of the Paulsboro refinery, 38,900 bbl. daily crude, and 27,500 cracking.

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Speakers for the thirty-fifth annual meeting of the Western Petroleum Refiners Association March 24-26 in San Antonio include S. A. Swensrud, executive vice president, Standard Oil Co. (Ohio); P. C. Keith, president, Hydrocarbon Research, Inc.; and T. H. Risk, Ethyl Corp.

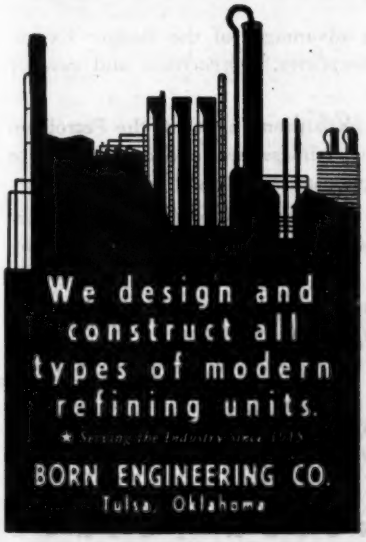
Tide Water Constructing New Distillation Unit

Construction of a 25,000-bbl. crude-oil distillation unit and a Petreco electrical desalter is now under way in the Avon, Calif., refinery of Tide Water Associated Oil Co. Completion of the new units is expected about September 1.

Design of the new units was accomplished by Tide Water and Bechtel Corp. engineers. Auxiliary equipment is being erected by several contractors.

H. Y. Hyde, vice president, said the design provides for a 15½-ft. diameter, 50-tray main fractionator to give close fractionation of products. Crude for the new distillation unit will come from Ventura Avenue field in California.

The Avon refinery now has a crude-oil capacity of 60,900 bbl. per day and a cracking capacity of 51,400 bbl. per day.



Rasbury to Head New Division of W.P.R.A.

James T. Rasbury, Washington, has been named director of the newly organized industrial-relations division of the Western Petroleum Refiners Association. The new department will be activated March 15.

H. T. Ashton, association president, said the division is being formed to keep members and the industry fully and promptly advised on current legislative matters, decisions, rules, and regulations, and in addition, all statistical information believed important or beneficial.

Permits Issued for Pure Oil's Expansion Program

Four new buildings, for which Civilian Production Administration permits already have been issued, will take $3,936,000 of a proposed $9,000,000 expenditure by Pure Oil Co. in its expansion program at its Smith's Bluff refinery near Nederland, Jefferson County, Texas.

The additional facilities, designed to replace the company's lube plant at Marcus Hook, Pa., which was destroyed by fire before the war, will have an estimated annual output of 25,000,000 gal.

Construction permits already issued are for a one-story warehouse with loading platform, a two-story building with loading platform, a steel drum reclamation plant, and a 40 by 148-ft. building with a structural steel frame.

Work Under Way on Ethyl Drumming Plant

Construction was under way last week by Ethyl Corp. on a $750,000 drumming plant near Baton Rouge, La. C. W. Bond, resident manager, said the new plant is expected to be completed in December.

Bond said the plant will supply Ethyl antiknock compound to dealers in quantities smaller than tank-car shipments.

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EXCEL-SO

There are many ways of performing a task—but usually ONE way is the most efficient and successful way of doing it. If you are looking for cleaner, dryer products in the refinery, pipeline, or at the loading rack, install the original EXCEL-SO separator/filter. This will afford more efficient operation of petroleum product dispensing equipment and eliminate wear, maintenance, and repair to meters, valves, pumps, and heat exchangers; and keeps tanks clean.

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• E. B. Badger & Sons Co. is the original and sole manufacturer of BADGER Expansion Joints.

ONCE you install dependable, long-lasting Badger Packless Corrugated Expansion Joints, your pipe expansion problems are solved.

The flexing member of every one of these joints is made from a single piece of tubing; hence *no packing is required*. This eliminates costly and troublesome maintenance—assures long service without attention.

Other important advantages of the Badger Expansion Joint are its *simplicity, compactness* and *ease of installation.*

Badger Packless Expansion Joints for the Petroleum industry are made of stainless steel and other alloys to withstand high temperatures and resist corrosion.

A special heat treatment, after forming, further assures their resistance to corrosion, thereby lengthening their life of service.

For more information about these "life-time" expansion joints, write for Bulletin No. 100.

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PACKLESS CORRUGATED EXPANSION JOINTS

NATURAL GAS

Northern Natural Plans $24,500,000 Expansion

WASHINGTON.—Northern Natural Gas Co., Omaha, has filed an application with the Federal Power Commission asking authority to construct additional facilities to increase its natural-gas pipe-line capacity to 580,000,000 cu. ft. daily to enable it to meet increasing firm gas needs in markets north of its Clifton, Kans., compressor station.

Total cost has been estimated at $24,500,000. Funds would be secured through the issuance of additional debentures and common stock.

Facilities proposed include construction of a new compressor station with installed capacity of 10,000 hp. near Garden City, Kans., and 320 miles of 26-in. pipe line extending from the new compressor station to Palmyra, Neb.; 245 miles of 24-in. line to complete the existing partial line looping from Palmyra to Farmington, Minn.; 17.3 miles of 20-in. line from Palmyra to a point in Saunders County, Nebraska; the installation of an aggregate of 8,200-hp. units in existing compressor stations along the line; a dehydration plant and appurtenant equipment.

The company plans to begin construction as soon as materials and supplies are available and contracts made. Gas reserves of the company are stated by the company to be not less than 3.3 trillion cubic feet and are located in Panhandle field in Texas and Hugoton and Otis gas fields in Kansas.

Present capacity of Northern Natural's system is approximately 325,000,000 cu. ft. per day, but is proposed to be increased to 407,000,000 cu. ft. per day upon construction of facilities for which authorization is sought in another proceeding now pending before the commission.

Memphis Natural Gas Held Liable for Mississippi Tax

JACKSON, Miss.—In a decision handed down last week by the Mississippi Supreme Court, Memphis Natural Gas Co. was held liable for Mississippi franchise taxes.

The court held that such taxes on gas pipe lines through the state were not based on the company's doing business in the state but as recompense for protection of the lawful activities of the pipe-line operators. Memphis Natural contended that it was not engaged in intrastate commerce in Mississippi and that its business, so far as the state was concerned, has been interstate solely and exclusively. Memphis Natural has 135 miles of lines through Mississippi, from the Monroe gas field to Memphis, plus two compressor stations.

Ohio Fuel Gas Rate Reduction Approved

WASHINGTON.—The Federal Power Commission has approved a rate schedule filed by Ohio Fuel Gas Co. reducing its firm wholesale rates by 0.7 cent per mcf. The schedule is to be effective as of September 30, 1946, and will result in an annual reduction of approximately $129,000 to Ohio Fuel's wholesale customers on the basis of 1945 sales.

The new rate schedule was filed by Ohio Fuel to reflect a corresponding reduction in purchased gas costs from United Fuel Gas Co. ordered by the commission.

Holiday Seen in Sale of Gas Heating Appliances

PITTSBURGH, Pa.—A moratorium on the sale of gas heating appliances except for newly constructed homes was predicted here recently by Raymond Little, general sales manager of Equitable Gas Co.

Little said natural-gas companies will require a year to obtain and install pipe and materials for expansion of existing facilities to increase the flow of gas from the Southwest, and said sales of gas-consuming equipment must be held up until the gas becomes available.

His forecast followed the appeal of six companies in western Pennsylvania for permission to deny service to new domestic customers. Previous appeals also have asked home owners to postpone conversion of their heating systems to gas.

California Transmission Conference Scheduled

The Pacific Coast Gas Association has scheduled a transmission conference May 14-15 in the Hotel Californian in Fresno.

Chairman of the conference is E. H. Fisher, manager of the gas division, Pacific Public Service Co. The agenda is not yet complete but will cover all current matters of interest in maintenance and construction of transmission lines, measurement of gas in large volume at high pressures, and the use of oil, gas and L.P.G. in augmenting the gas supply during peak-load periods, it was announced.

T. G. & T. Gas Deliveries 29 Per Cent Above 1945

In a letter to stockholders accompanying the company's annual report, Gardiner Symonds, president of Tennessee Gas & Transmission Co., Houston, said that deliveries of natural gas to customers in the Appalachian area during 1946 were approximately 29 per cent higher than in 1945.

This was due, he added, to strong demand for gas and the fact that during 1946 additional horsepower was added to existing T.G.&T. compressor stations and a 21-mile section of main-line loop was placed in operation. Present T.G.&T. deliveries approximate 290,000,000 cu. ft. daily, and additional facilities will raise this to 381,000,000 cu. ft. daily.

Royalty Owners Again Ask Action Against FPC

The Panola County (Texas) Royalty Owners Association last week again asked its members to vigorously oppose the Federal Power Commission in its control of natural-gas activities.

At a meeting in Houston, members were requested to ask their congressmen to amend the Natural Gas Act so as to deny FPC jurisdiction over production and gathering, the power to fix the price of gas, and the authority to specify for what purpose it shall be used.

Natural Gasoline

Coon Creek To Get New Gasoline Plant

A gasoline plant featuring recently patented design features of L. S. Gregory, design engineer, will be built in Coon Creek field of Logan and Oklahoma counties, Oklahoma, by Otha H. Grimes, producer and natural-gasoline manufacturer.

The new plant will process the field's output of 2,000,000 cu. ft. of natural gas daily, produced from the Wilcox sand. It will produce gasoline and liquefied-petroleum-gas products and return the dry and processed gas to fuel lines at 300 psi.

STATISTICS and T

WEEKLY WELL COMPLETIONS . . . WEEK ENDED MARCH 1, 1947

	Total of all wells					Cum.		Wildcat completions and discoveries					Cumulative total, 1947				
	Comp.	Oil	Gas	Dry	Footage	1947	1946	Oil	Dist.	Gas	Dry	Total	Oil	Dist.	Gas	Dry	Total
New York	25	13	0	*12	40,008	240	256	0	0	0	0	0	0	0	0	0	0
Pennsylvania	61	31	5	†25	92,727	554	730	0	0	0	0	0	0	0	0	0	0
West Virginia	16	0	15	1	46,828	145	105	0	0	0	0	0	0	0	0	0	0
Ohio	23	3	13	7	67,864	210	168	0	0	0	1	1	0	0	1	7	8
Indiana	8	6	1	1	16,851	64	51	0	0	0	0	0	1	0	0	5	6
Kentucky	9	2	3	4	22,057	64	74	0	0	0	0	0	0	0	0	8	8
Illinois	38	20	0	18	96,765	319	318	0	0	0	4	4	12	0	0	50	62
Michigan	10	0	0	10	17,914	111	112	0	0	0	5	5	0	0	3	43	46
Kansas	44	16	4	‡24	152,761	442	348	0	0	0	11	11	8	0	4	50	62
Neb., Mo., Iowa	0	0	0	0	0	1	4	0	0	0	0	0	0	0	0	1	1
Oklahoma	69	40	6	23	213,587	683	409	3	0	0	7	9	16	0	1	136	152
Texas	154	94	7	53	750,673	1,307	1,297	6	0	0	36	42	42	5	12	207	265
North Central	48	24	1	23	163,348	482	439	3	0	0	14	17	18	0	4	76	98
West	44	37	0	7	218,546	323	281	1	0	0	6	7	3	0	1	31	35
Panhandle	5	3	2	0	16,170	76	69	0	0	0	0	0	1	0	0	1	2
Eastern	6	2	1	3	37,616	76	118	0	0	0	1	1	1	0	0	18	19
Gulf Coast	22	12	0	10	165,243	253	307	0	0	0	9	9	11	5	6	41	63
Southwest	29	16	3	10	149,750	155	83	2	0	0	6	8	7	0	1	40	48
Louisiana	23	10	5	8	115,380	199	205	0	1	0	4	5	7	4	0	26	37
Northern	17	6	5	6	57,694	100	101	0	0	0	3	3	0	0	0	16	16
Southern	6	4	0	2	57,686	99	104	0	1	0	1	2	7	4	0	10	21
Arkansas	2	2	0	0	6,955	34	31	0	0	0	0	0	0	0	0	6	6
Mississippi	2	1	0	1	14,734	54	38	0	0	0	1	1	0	0	1	17	18
Southeastern States	0	0	0	0	0	9	8	0	0	0	0	0	0	0	0	8	8
Montana	0	0	0	0	0	27	41	0	0	0	0	0	0	0	0	4	4
Wyoming	10	7	0	3	33,682	43	31	0	0	0	2	2	3	0	1	9	13
Colorado-Utah	2	0	0	2	7,738	23	18	0	0	0	2	2	1	0	0	6	7
New Mexico	13	11	1	1	69,093	82	69	1	0	0	0	1	2	0	0	8	10
California	33	29	0	4	188,400	331	299	0	0	0	3	3	2	0	0	48	50
Total United States	542	286	60	196	1,956,017	4,945	4,612	13	1	0	75	86	95	9	24	638	783
Total previous week	570	310	63	197	1,909,267	4,403	4,146	9	0	1	63	73	84	8	23	562	677
Total Mar. 2, 1946	466	278	45	143	1,642,422			14	0	1	33	48	75	2	22	497	596

Service wells included: *12, †23, ‡1.

Revised.

MARKET QUOTATIONS

GRAVITY SCHEDULES

Top prices include all gravities above grades designated, and low prices include all gravities below grades designated:

Gravity—	Signal Hill, Calif.	Oklahoma, Kansas	Gulf Coast Tex.*	West Tex.†
18-18.9	$1.17	....	....	....
19-19.9	1.21	....	....	....
20-20.9	1.24	$1.30	....	$1.17
21-21.9	1.28	1.32	....	1.19
22-22.9	1.32	1.34	....	1.21
23-23.9	1.35	1.36	....	1.23
24-24.9	1.39	1.38	$1.61	1.25
25-25.9	1.43	1.40	1.63	1.27
26-26.9	1.46	1.42	1.65	1.29
27-27.9	1.50	1.44	1.67	1.31
28-28.9	1.54	1.46	1.69	1.33
29-29.9	1.57	1.48	1.71	1.35
30-30.9	1.61	1.50	1.73	1.37
31-31.9	....	1.52	1.75	1.39
32-32.9	....	1.54	1.77	1.41
33-33.9	....	1.56	1.79	1.43
34-34.9	....	1.58	1.81	1.45
35-35.9	....	1.60	1.83	1.47
36-36.9	....	1.62	1.85	1.49
37-37.9	....	1.64	1.87	1.51
38-38.9	....	1.66	1.89	1.53
39-39.9	....	1.68	1.91	1.55
40 and above	....	1.70	1.93	1.57

*For crude from Daboval, El Campo, and Sandy Point. †Includes Lea County, New Mexico.

(Quotations shown here are f.o.b. plant in tank cars and in cents per gal. as of last Monday.

REFINERY GASOLINE

Octane (A.S.T.M.)	78-80† 73-75
Mid-Continent*	7.500-7.750 6.875-7.250
Tex. Gulf Coast	7.50-7.75 6.750-7.125
New York Harbor	9-10.75 8-9.25

*Basic Oklahoma Group 3. †1939 C.F.R. (research method).

NATURAL GASOLINE

Grades—	26-70	18-55
Oklahoma (Group 3)	5.125	6.150
N. Texas (f.o.b. plant)	4.625	5.550
N. Louisiana (f.o.b. plant)	4.875	5.850

CRUDE-OIL PRICES

Representative posted schedules per bbl.	
East Texas	$1.70
Kettleman Hills, California*	1.69
Beauregard Parish	1.65
Illinois Basin	1.82
Pecos County, Texas (Yates)	1.40
Bradford, Pennsylvania	3.65
Eastern Ill., and Western Ind.	1.67
Tomball, Texas Gulf Coast	1.85

Note: Crude prices exclusive of subsidy.

A.P.I. REFINERY REPORT

(Week ended February 22, 1947)
(Figures in thousands of barrels)

	Dly. crude runs to stills	Stocks— Gasoline	Distillate	Residual
East Coast	776	22,200	14,761	6,507
Appalachian	167	3,579	554	336
Ill., Ind., Ky.	809	21,041	2,925	2,431
Okla., Kan., Mo.	371	10,529	1,349	1,035
Inland Tex.	228	4,424	312	734
Tex. Gulf Cst.	1,156	15,808	7,058	5,214
La. Gulf Cst.	343	5,112	2,337	1,578
N. La., Ark.	65	2,362	449	118
Rocky Mt.	140	2,941	519	739
California	805	15,908	10,475	26,147
Total 2-22-47	4,860	103,904	40,739	44,919
Total 2-15-47	4,737	103,048	42,793	46,515
Total 2-23-46	4,629	104,921	26,086	39,321

CRUDE-OIL STOCKS

(Bureau of Mines Estimate)

Week ended—	Bbl. of Crude*
February 22, 1947	224,580,000
February 15, 1947	222,013,000
February 23, 1946	226,699,000

*Excludes unrefinable Calif. stocks.

TRENDS

DAILY AVERAGE PRODUCTION FOR WEEK

	Mar. 1 crude oil	B. of M. Feb. demand	Feb. 22 crude oil
Alabama	900	1,200	900
Arkansas	79,950	76,000	80,500
California	899,700	838,000	901,500
Colorado	38,040	33,000	38,710
Eastern	63,400	64,200	59,000
Florida	115	200	240
Illinois	196,200	204,000	191,000
Indiana	18,000	18,000	17,700
Kansas	271,800	263,000	280,350
Kentucky	27,500	28,000	27,000
Louisiana	411,700	387,000	412,500
North Louisiana	101,400	.....	102,200
South Louisiana	310,300	.....	310,300
Michigan	44,135	46,000	41,760
Mississippi	84,985	66,000	82,685
Montana	22,550	23,000	24,400
Nebraska	700	800	700
New Mexico	103,400	98,000	103,400
Oklahoma	369,150	370,000	370,050
Texas	2,056,665	2,030,000	2,056,665
District 1 (Southwest)	19,950	.....	19,950
District 2 (Southwest)	146,025	.....	146,025
District 4 (Southwest)	223,250	.....	223,250
District 3 (Gulf Coast)	451,000	.....	451,000
District 5 (Eastern)	36,440	.....	36,440
District 6 (Eastern)	106,100	.....	106,100
East Texas field	328,200	.....	328,200
District 7-C (West)	32,665	.....	32,665
District 8 (West)	467,455	.....	467,455
District 7-B (W. Central)	36,100	.....	36,100
District 9 (N. Central)	126,355	.....	126,355
District 10 (Panhandle)	83,125	.....	83,125
Wyoming	107,840	93,000	109,250
Miscellaneous	.....	600	.....
Total United States	*4,796,730	4,640,000	4,798,310

Change from prev. week, down 1,580

Total production January 1-March 1 ..... †284,081,190 bbl.

Same period last year (crude plus condensate)... 286,703,120 bbl.

*Not incl. 26,420 bbl. condensate. †Incl. 1,548,080 bbl. condensate.

CRUDE-OIL STOCKS 224,580,000 bbl. as of February 22—up 2,567,000 bbl. One year ago 226,699,000 bbl.

GASOLINE STOCKS 103,904,000 bbl. as of February 22—up 856,000 bbl. One year ago 104,921,000 bbl.

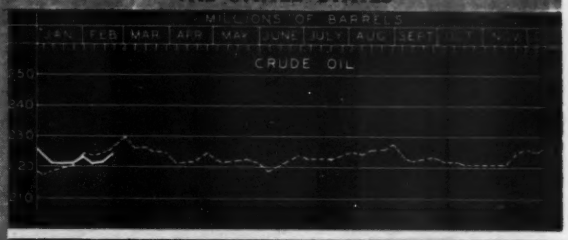
RESIDUAL FUEL-OIL STOCKS 44,919,000 bbl. as of February 22—down 1,596,000 bbl. One year ago 39,321,000 bbl.

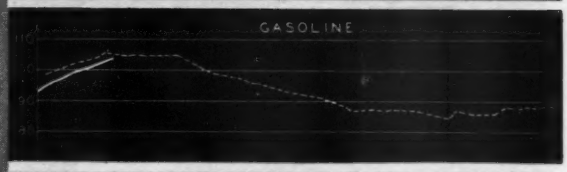
GAS OIL AND DISTILLATE STOCKS 40,739,000 bbl. as of February 22—down 2,054,000 bbl. One year ago 26,086,000 bbl.

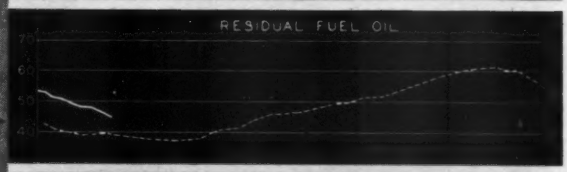
CRUDE-OIL PRODUCTION 4,796,730 bbl. as of March 1—down 1,580 bbl. One year ago 4,709,470 bbl.

REFINERY RUNS 4,860,000 bbl. daily week ended February 22—up 123,000 bbl. One year ago 4,629,000 bbl.

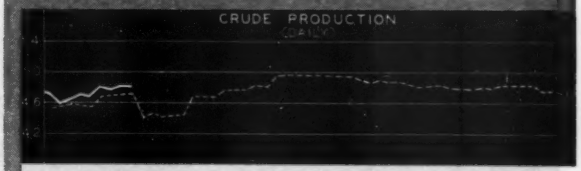
OIL STOCKS IN THE UNITED STATES

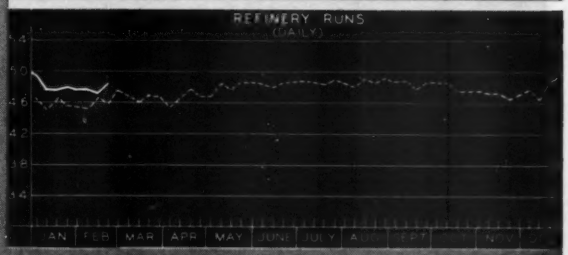




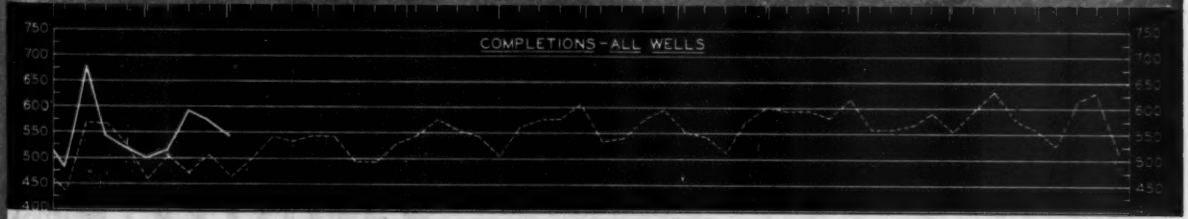


DAILY OPERATIONS





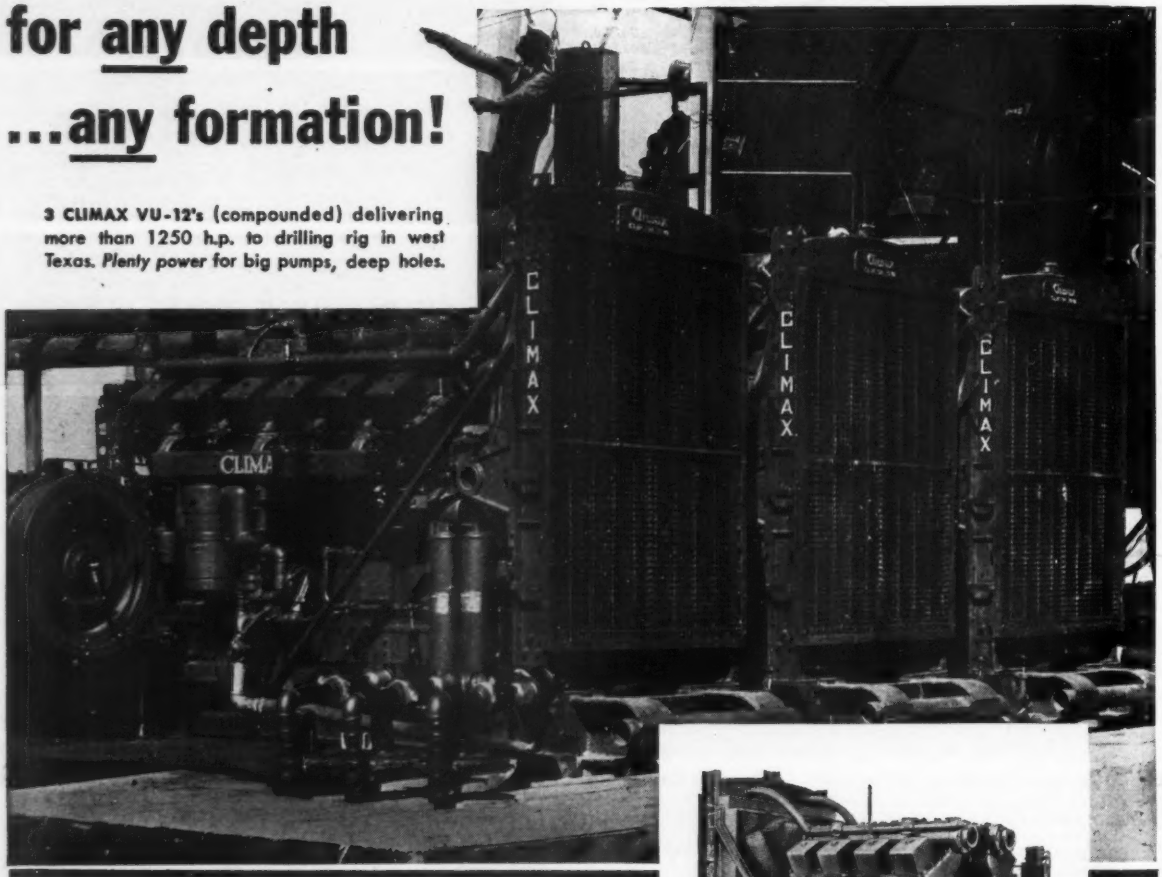
Solid line charts weekly completions, service wells in Eastern area included.



PLENTY of POWER

for any depth ...any formation!

3 CLIMAX VU-12's (compounded) delivering more than 1250 h.p. to drilling rig in west Texas. *Plenty power* for big pumps, deep holes.



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- ★ Fast, smooth acceleration.
- ★ Rugged construction.
- ★ Medium speed.
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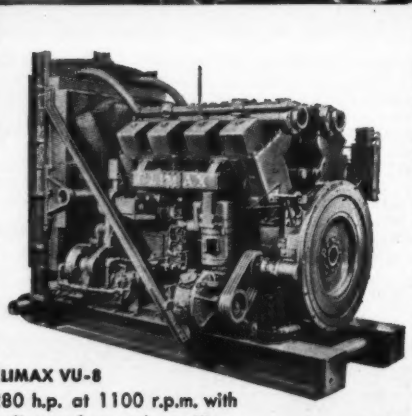
- ★ Parts stocked at all active field points.
- ★ Expert field servicing.



CLIMAX VU-8
280 h.p. at 1100 r.p.m. with radiator, fan and auxiliary equipment. 8 cylinder (7x7), 4 cycle type.

For every drilling job—for every depth or formation—Climax Power will make hole at *lowest* cost per foot.

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Here's the extra power you need for extra profits on deep, footage-contract jobs. Write for illustrated bulletin and engineering data.

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Exploration and Drilling

Some Practical Geological Problems

RESEARCH workers frequently fail to explain their problems in terms that mean something to the average oil operator. For instance, this week four wells, widely scattered from Wyoming to New Mexico, pose problems of a nature that fits in with some of the geological research now being mapped out.

Mush Creek Production Co. 1 Roberts, SW SE SW 10-44n-63w, Weston County, Wyoming, an extension and second well in the Mush Creek pool, was making 300 bbl. per day of 41.7° gravity oil from 14-ft. penetration into the second Newcastle sand, topped at 4,018 ft. Not a bad well for depth and gravity of oil in any man's country, and one that makes Mush Creek pool look attractive. But Mush Creek is probably a stratigraphic-trap pool, and furthermore lies 8 to 10 miles farther inner basinward in the Powder River basin than the only important previous oil find, the Osage field.

The successful well is ¼ mile northwest of the discovery, but an attempt to step about 3 miles southeast failed at about the same time as the second success, because the southeast extension well, Morton Drilling Co. 1 State, NE NE NE 25-44n-63w, found the Newcastle sand almost completely shaled out, finding only 1 ft. of saturated sand.

Here is an area where the problems to be solved comprise aspects of stratigraphic traps, what happens in stepping deeper into basins, and problems in sedimentology. If we knew more about these things, the boundaries of this field might be determined without drilling as many dry holes as will probably result in normal development under present-day limitations of knowledge.

Down in Baca County, Colorado, J. M. Huber-Frontier Refining Co. 1 Ingle, SW SW SE 27-29s-50w, was abandoned at 4,947 ft. in the Mississippian. This is the third dry hole on the west side of the Anadarko basin, all based on evidence from an old 1928 test by Marland Oil Co. in 8-30s-50w, which found granite at 2,089 ft. Here again, lack of sufficient knowledge of sedimentology makes it expensive to find stratigraphic traps.

The fourth well, English-Byrd-Frost 1 Government, NW SW 4-27n-10w, Kutz Canyon gas field in San Juan County, northwest New Mexico, after recovering 3½ ft. of bleeding core in the top of the Dakota sand in a deep test, looks disappointing in the first Dakota on further testing, because the sand apparently shaled up. This is not definite as yet, and there is still a good shot in the second Dakota, some 50 ft. deeper than present total depth, if further tests continue disappointing. More problems in sedimentology. What are prospects in other places on this structure, if this well shows good, but not quite enough for a commercial producer?

EASTERN TEXAS

Marion County Deep Test Conditioning Mud

DALLAS.—Magnolia Petroleum Co. and Tide Water Associated Oil Co.'s deep test in the Lassater area of northwest Marion County, the 1 Hall had total depth at 10,208 ft. and was conditioning mud after an unsuccessful drill-stem test. With the packer set at 10,135 ft., ¼-in. choke on bottom and the top open for 40 minutes, total recovery was five stands of rotary mud, with no shows of oil or gas. Perforations through casing were at 10,-145-65 ft.

Gulf Oil Corp. 1 Laco Oil Corp., in the J. M. Fowler Survey, and on the southwest flank of the Opelika field, Henderson County, was below 9,170 ft. in limestone on last report. Cores at 8,771-91 ft. recovered 6½ ft. of hard, gray limestone with gas odor and no porosity except for a few broken fragments. The bottom 6 in. showed broken porosity with a light-oil odor and taste.

Delta Drilling Co. et al 1 Frances Lester, 10,000-ft. test 2½ miles northeast of Gallatin, Cherokee County, was below 5,696 ft. in shale and limestone. On an elevation of 320 ft., tops logged were: Pecan 3,652 ft., Austin chalk 4,175-4,340 ft., Woodbine sand, with salt water 4,340 ft., Comanche shale 4,775-90 ft., limestone 4,820-35 ft., It is scheduled to test the Travis Peak.

In Smith County, 2½ miles northeast of Lindale, Delta Drilling Co. 1 H. G. Lyons was drilling below 7,901 ft. in sand and shale, after recovering fish. Sample top on the Paluxy was 7,745-57 ft.

Bobby Manziel 1 Shamburger, tight well being drilled on the Quitman townsite, was reported to be down to 5,650 ft. in sand and shale, cutting 1 to 2 minutes per foot. Electric log was said to have been run without results.

In Anderson County, 5 miles southwest of Elkhart, Blue Bird Investment Co. 1 J. H. Pearson was drilling below 5,595 ft. in sand and shale. A drill-stem test at 5,140-5,523 ft., ½-in. top and bottom chokes, produced a blow immediately and increased to 1,300 lb. in 4 minutes. After shut in 5 minutes, it cleared itself in 3 minutes. Maximum flowing pressure was 2,300 lb. The flow of gas, not gaged, was accompanied by a small amount of water-white distillate.

EAST TEXAS WILDCAT FAILURE

Collin County: Standard Oil Co. of Texas 1 Newsome Ranch, John W. Cox Sur., 3 mi. E Frisco, dry, TD 8,261 ft., no shows, sand with oil stain 4,851-61 ft., slight show in sand 6,660-71 ft., hard, tight sand with oil stain and gas odor 6,747-62 ft., DST produced light blow but died.

SOUTH LOUISIANA

Mamou Pool Production Extended ½ Mile Southwest

NEW ORLEANS.—Magnolia Petroleum Co. has extended production at Mamou pool in Evangeline Parish ¼ mile to the southwest. The 1 Ophelia Ledoux, NW NW 7-5s-1e, is running tubing for completion after a drill-stem test flowed at the rate of 105 bbl. of oil per day through ¼-in. and 5/64-in. chokes. It has 3,700 lb. flowing pressure and gaged 160,000 cu. ft. of gas at a daily rate, ratio 1,524.

Sohio Petroleum Co. 1 Charles Richard, wildcat test in the Grand Chenier area of Cameron Parish, 1-15s-5w, 9 miles southwest of Pecan Lake and 8 miles southeast of Little Chenier gas field, has indicated a new gas-producing area. Electrical log was run in the hole to 10,125 ft. and side-wall samples taken at 8,250-86 ft. and 8,367-99 ft. showed gas with no oil cut. Cored sands from 10,260-300 ft. showed gas. Operators are drilling ahead below 10,622 ft. on an 11,000-ft. contract.

Magnolia 1-C Lutcher, 24-14s-11w, 4 miles northeast of Mud Lake field in Cameron Parish, made a slight blow on drill-stem test at 11,639-659 ft. Perforations were squeezed and hole plugged back for a second test at 11,589-609 ft. where a drill-stem test showed a slight gas blow, using ¼-in. chokes top and bottom. Total depth is 11,705 ft., with 7-in. pipe cemented at 11,012 ft. and 5-in. liner from 10,855-11,705 ft. The test is credited with other sands which will be tested.

Barnsdall Oil Co. is attempting a completion from a new and lower sand in the Cockfield at its 2 Long Bell Lumber Co., second test in its Longview discovery area of Beauregard Parish. At last report well was cleaning, flowing wash water, gas and oil, with 450 lb. tubing pressure and 800 lb. pressure on the casing. Sands being tested are from 8,570-86 ft. Total depth is 9,001 ft. and 5½-in. pipe is cemented at 8,570 ft. This test is ¼ mile northwest of the discovery and is in Section 1-6s-10w.

Fourteen new locations were reported for South Louisiana this week, four being wildcats, three in Terrebonne and one in

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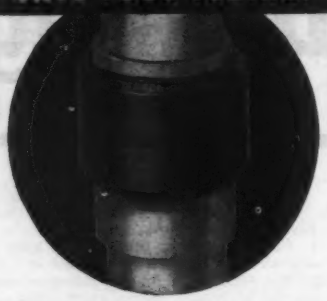

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Iberia parishes. Four oil wells and two dry holes were completed this week. One new gas-condensate sand in Cameron Parish and one dry hole in Acadia Parish were the only exploratory completions. Acadia and Iberville parishes each received two completions while Cameron and St. Mary parishes showed one each.

SOUTH LOUISIANA SUCCESSFUL WILDCAT

Cameron Parish: New gas-condensate sand, and ½-mi. south extension Cameron Meadows pool—Magnolia et al 45 Cameron Meadows Land Co., 28-14s-13w, TD 9,500 ft., top sand 8,678 ft., perf. 8,686-96 ft., IP 67 bbl. condensate per day and 689,000 cu. ft. gas per day through 7/16-in. choke, ratio 10,141, TP 3,200 lb., grav. 58°, no water.

SOUTH LOUISIANA WILDCAT FAILURE

Acadia Parish: Phillips Petroleum Co. 1 Hoffpauer, 16-10s-1e, Crowley area, dry, TD 10,520 ft.

SOUTHWEST TEXAS

Deeper Gas Pay Opened In East Alice Area

CORPUS CHRISTI.—Magnolia Petroleum Co. 1 David Clarke, new oil discovery in Jim Wells County, about a mile west of Seeligson field and southwest of the discovery well in the Haldeman area, has completed its potential gage, making 98 bbl. of 47.8°-gravity oil per day through a ½-in. choke, with 750 lb. tubing pressure and gas-oil ratio of 605. The well is completed through perforations at 4,502-10 ft. Total depth is 6,505 ft., with 5½-in. casing at 6,050 ft. Perforations at 4,185-92 ft., 4,192-4,200 ft., and 4,200-10 ft. all tested dry.

A new deeper gas pay for the East Alice area of Jim Wells County has been opened by H. J. Mosser and Houston Natural Gas Corp. 5 A. O. Cook at the 5,600-ft. level. Deepest production previously was from the 5,300-ft. pay. Drilled to a total depth of 8,010 ft., operators plugged back to 5,732 ft. and perforated at 5,627-32 ft. for gas-condensate completion. No gage has been made of the flow; shut-in pressure is 2,200 lb. Well is located 3½ miles south of Alice, in the La Vaca Grant.

C. P. Burton et al 2 Mauro Villareal, 1,230 ft. north of the 1 Villareal, 5,900-ft. sand discovery drilled by Daubert & Achning et al about 1½ miles east of the 5,700-ft. deep sand discovery on the southwest end of Kelsey field, Starr County, has been completed in another new and deeper pay zone for this sector of the Kelsey (deep) field, which is known tentatively as Kelsey (South). On potential gage it flowed 144 bbl. of 44.8°-gravity oil per day through a 9/64-in. choke, with 950 lb. tubing pressure, and gas-oil ratio of 591, no water. Pay was topped at 6,062 ft.

Shell Oil Co., Inc. has completed 1 W. P. Wright, second test in the East Falfurrias field in the extreme southwest corner of Kleberg County. It flowed 95 bbl. of condensate and 6,400,000 cu. ft. of gas per day through a ¾-in. choke, with 2,250 lb. tubing pressure, through perforations at 9,150-69 ft., 76 shots, and 9,195-9,207 ft., 36 shots. This well is located in the center of Lot 8, Section 24, Burton & Danforth subdivision of Parrita Ranch, in El Paisano Ramon de la Garza Grant, Abstract 110. The 1 Von Hoogenhuyze, discovery well, was drilled in Jim Wells County, 5 miles southeast of La Gloria, but had considerable mechanical trouble and was junked with collapsed casing. The new well lies southeastward across the county line from the discovery, and was completed in a deeper pay. Total depth is 10,310 ft., with the 5½-in. casing set to 9,260 ft.

There were 26 new locations reported this week, 8 wildcats, located 3 in Nueces, 2 each in Hidalgo and McMullen, and 1 in Duval counties. Two new oil pools were opened, one each in Jim Wells and Kenedy counties. Six dry wildcats were completed, one each in Atascosa, Brooks, Cameron, Milam, San Patricio, and Starr counties. Duval County received the greatest activity, receiving four completions.

SOUTHWEST TEXAS SUCCESSFUL WILDCATS

Jim Wells County: New oil pool—Magnolia 1 David Clarke, Sec. 62, R. P. Haldeman subd. of Seeligson Ranch, 7 mi. SW of Ella, 1 mi. W of Seeligson field, TD 6,505 ft., top pay 4,495 ft., perf. 4,502-10 ft., IP 98 bbl. oil per day through a ¼-in. choke, gas-oil ratio 650, TP 750 lb., casing sealed, gravity 47.8°, no water.

Kenedy County: New oil pool—Atlantic 1 H. F. McGill et al, Santa Rosa de Arriba Grant, TD 9,905 ft., top pay 7,672 ft., perf. 7,676-80 ft., IP 47 bbl. per day net oil through 9/32-in. choke, gas-oil ratio 1,067, TP 625 lb., casing sealed, gravity 46.2°, 59 per cent water.

SOUTHWEST TEXAS WILDCAT FAILURES

Atascosa County: Arkansas Fuel Oil Co. 1 Adolph Jasik, Namuel Escalera Sur. 1236, 4½ mi. NE of Leming, dry, TD 4,316 ft. in Edwards lime.

Brooks County: H. H. Howell 1 J. T. Maupin, CCSD&RGNG Sur. 311, 16 mi. SW of Falfurrias, on S flank of Alta Verde dome, TD 3,779 ft.

Cameron County: Standard Oil Co. of Texas and Shell 1 W. S. Parks, Share 22, Potrero del Espiritu Santo gr., 7 mi. NE of Rio Hondo, dry, TD 9,902 ft.

Milam County: Milam Co. Producers 1 E. Simms, Jose de Costa Grant, ¼ mi. NE of Tracy, dry, TD 1,310 ft.

San Patricio County: H. R. Smith 1-A R. R. Pyron, Lot 7, Sec. 8, Coleman-Fulton Pasture Co. first subd. of Farm Lots, 1½ mi. NW of Taft, dry, TD 9,513 ft.

Starr County: W. B. & Jewel Osborn 1 W. B. Osborn, Sur. 87, 30 mi. N of Rio Grande City, dry, TD 5,450 ft.

LA.-ARK.

Miller County Test Has Only Shows of Oil

SHREVEPORT.—On the northwest flank of the Fouke field, Miller County, Arkansas, Carter Oil Co. 1 Philyaw, 36-16s-27w, had total depth at 7,505 ft. in Cotton Valley, and had logged only shows of oil and gas. Casing was set to 6,308 ft., drilled out to 6,263 ft., and on a drill-stem test at that depth it returned the 1,000 ft. of water cushion in 5 hours and then flowed small amounts of drilling mud with a show of gas. Electric log tops were: Paluxy sand, with show of oil, 4,316-40 ft., Kilpatrick limestone showing oil, 4,920-56 ft., Travis Peak, showing oil, 6,124-40 and 6,240-56 ft. Derrick-floor elevation is 307 ft.

In Union County, McAlester Fuel Co. 1-A Patterson, 19-18s-14w, had total depth at 7,302 ft. in Smackover and had squeezed perforations in that section. Perforations in the Travis Peak at 4,133-35 ft. were also squeezed and operators were waiting on cement. Electric-log tops were: Arkadelphia 1,968 ft., Tuscaloosa 2,900 ft., lower Glen Rose 3,070 ft., Travis Peak 3,452 ft., Cotton Valley 4,900 ft., Buckner 7,325 ft., Smackover 7,260 ft., on an elevation of 215 ft.

In Madison Parish, Louisiana, Kinard's 1 Ayer Timber Co., 19-15n-10e, 10 miles south and a little east of Delhi, squeezed perforations at 5,630-39 ft., and reperforated at 5,631-37 ft., from which it flowed 6 bbl. of 65°-gravity distillate in 2 hours through 3/16-in. tubing choke, plus some 1,250,000 cu. ft. of gas. There was no salt water. Tubing pressure was 1,750 lb., casing

pressure 1,975 lb. Operators continued testing.

In Winn Parish, Stanolind Oil & Gas Co. 1 Tremont, 30-12n-1w, was drilling below 8,026 ft. in the Glen Rose, topped at 7,300 ft., by drillers' samples.

NORTH LOUISIANA WILDCAT FAILURES

Bossier Parish: J. B. Blanchard 1 W. C. Upton, SE NW 34-20n-11w, dry, TD 2,925 ft., Blossom 1,935 ft., Tuscaloosa 2,570 ft., Paluxy 2,660 ft., Glen Rose 2,859 ft., elev. 236 ft.

Claiborne Parish: F. B. King 1 M. Maritzky, W½ SW NW 27-23n-6w, dry, TD 5,211 ft., Midway 1,465 ft., Nacatoch sand 2,170 ft., Tuscaloosa 4,312 ft., upper Glen Rose 3,620 ft., Massive anhydrite 3,950-4,152 ft., James limestone 4,730 ft.

De Soto Parish: C. H. Murphy, Jr., 1 Edwards, NE SE 16-13n-14w, dry, TD 4,331 ft., Nacatoch 1,420 ft., Lower Cretaceous 2,932 ft., Paluxy 3,060 ft., Glen Rose 3,550 ft., elev. 346 ft.

MICHIGAN

Ten Wells Completed Without α Producer

SAGINAW.—Ten completions without a producer in the lot stacked up with 17 new locations in the least successful week in years in Michigan oil fields. Five of the 10 dry holes were wildcats, 3 of those being in Allegan County. The activity center shifted to Tuscola County as Ervin Major and Fred Riddell obtained eight permits for oil-well locations in Arabela Township, planning development of the Arbela pool now producing from three wells. All the new locations are in Section 33. Three of the other locations are in Allegan County, two in Montcalm, one each in Kent, Newaygo, Osceola, and Van Buren.

MICHIGAN WILDCAT FAILURES

Allegan County, Casco Township: Louis Zellman 1 Rosen, NE NE SW 27-1n-16w, dry in Traverse limestone, TD 1,138 ft.

Heath Township: Wayne C. Prather 1 James and J. T. Prins, SE SW SW 16-3n-14w, dry in Traverse limestone, TD 1,487 ft.

Monterey Township: Frank Seifert, Tr. 1 Otto Arndt, NE SW SW 2-3n-13w, dry in Traverse limestone, TD 1,715 ft.

Bay County, Gibson Township: W. L. McClanahan 1 Martin Wasalaski, SW NE NE 28-18n-3e, dry in Dundee, TD 3,112 ft.

Berrien County, Niles Township: Sewage Sanitation Co. 1 C. and L. Stafford, SE SW NW 1-7s-17w, dry in Traverse limestone, TD 665 ft.

CANADIAN FIELDS

Flush Production Confirmed In Leduc Discovery

CHATHAM.—Testing operations are still in progress at Imperial-Leduc 1, LSD 5, 22-50-26w4, discovery well in the new Leduc field south of Edmonton. Flush production is confirmed at 788 bbl. a day, and experiments are being made with varying pressures, after which acid may be used. The well, bottoming in Devonian limestone at 5,066 ft., is operating on a restricted production basis, the output being shipped to the Imperial refinery at Calgary. The original 1,000 bbl. of storage at the well has been increased.

Hon. N. E. Tanner, Alberta minister of lands and mines, states that the prospects for future development are very promising with oil of a good grade, adding, "I am advised by the company that there is a good thickness of lime containing a deep porous zone." Production of the well while testing runs around 300 bbl. daily.

Imperial-Leduc 2, LSD 1, 16-50-26w4, is below 1,200 ft. Location is south and west of discovery. Imperial-Leduc 3 has location on the John Halwa farm, 1 mile north and 1½ miles west of discovery. A fourth well is planned. Most of the immediate area is held by Imperial Oil, but other companies have obtained small holdings and are planning to drill. Home Oil of Calgary has NW¼ 21-50-26w4, ½ mile from discovery. Leduc-West Oil Co. has location in SW¼ 19-50-26w4, 2½ miles west.

Lloydminster.—Production of the Lloydminster field in 1946 is officially reported at 213,050 bbl., of which 76,187 bbl. came from Alberta and 153,702 from Saskatchewan. Most recent completion is Superior-Ponalta 1, LSD 4, 14-50-2w4, finished at 2,001 ft. and pumping 100 bbl. This completion further proves extension of the field to the north and west.

Ram River.—In the Ram River-Clearwater area, in the central Alberta foothills, Ram River Oils 4, LSD 9, 36-34-10w5, bottoming at 1,460 ft. encountered a porous horizon in Devonian limestone at 1,340-1,440 ft. and has set 7-in. casing at 1,352 ft. preparatory to shooting. Showings of light-green crude were found in cores, with good porosity. After a series of small shots, the well will be acidized. Ram River 3, LSD 12, 1-37-11w5, is redrilling below 3,400 ft. with production expected around 4,260 ft.

Hanna.—In the Hanna district, southern plains area, Berry Creek Petroleums 1, LSD 3, 9-31-14w4, is deepening below 3,171

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ft., after encountering gas showings below 2,900 ft.

Foremost.—In the Foremost gas field, southern Alberta, McColl-Union 6-D, LSD 6, 25-4-10w4, finished at 2,244 ft., got 16,000,000 cu. ft. gas after perforating at 2,170 ft. McColl-Union 10-D, LSD 10, 9-4-9w4, is below 2,197 ft. with drill-stem tests showing considerable gas. McColl-Union 10-B, LSD 10, 22-7-9w4, is deepening below 3,123 ft.

Lease extension.—Due to the difficulty of securing drilling equipment and materials, the Alberta Government has extended the time limit for drilling on provincial and school lands 1 year to April 1, 1948.

Wetaskiwin.—Production at the Imperial well in the new Leduc field has aroused interest in McColl-Frontenac 4-11-45-25, exploratory test in the Wetaskiwin area, now drilling below 5,803 ft. in LSD 4, 11-45-25w4. Location is approximately 7 miles west and 27 miles south of the Leduc discovery, but the Wetaskiwin location is part of the same plains area, though the Devonian limestone appears to be more deeply buried.

TEXAS GULF COAST

New Discovery Pool Opened in Matagorda Bay

HOUSTON.—A new oil-pool discovery in Matagorda Bay, in Calhoun County, 4½ miles north of Port O'Connor, has been opened at The Texas Co. et al 1 State (Amerada unit). On initial gage, it flowed 192 bbl. of oil per day through a 3/16-in. choke, tubing pressure 600 lb., with casing sealed, and the oil was 27°-gravity pipe-line oil, no water. Production is through perforations at 4,970-78 ft. in the Miocene. Total depth is 11,530 ft., with 9⅝-in. casing at 6,121 ft. Operators are running potential test.

Magnolia Petroleum Co. 1 Jess Adams, in GH&H Survey, extended the gas-condensate production in the Chesterville field, Colorado County, 1 mile westward. On potential gage it flowed 75 bbl. of 46°-gravity condensate along with 4,000,000 cu. ft. of gas through 8/64 and 11/64-in. chokes. Flowing pressure was 2,559 lb., on tubing and 2,650 lb. on casing. Calculated open flow was 7,600,000 cu. ft. daily. Total depth is 9,608 ft., and perforations for completion are from 9,557-9,602 ft.

Also in Colorado County, Shell Oil Co., Inc. 1 J. H. Criswell, northwest outpost well in the Sheridan field, flowed 155 bbl. of 57°-gravity condensate daily, plus 15.4 bbl. of salt water and 2,521,000 cu. ft. of gas daily through a ¼-in. choke. Flowing pressure 2,235 lb. on tubing and 2,408 lb. on casing. Total depth is 10,460 ft., with production from perforations at 9,374-98 ft.

Stanolind Oil & Gas Co. 1 E. P. Ruhman, south flank test at Burnell-Wilcox field, in Karnes County, indicated first oil production from the third sand, or Massive Wilcox zone, on a drill-stem test at 6,970-78 ft. when it began flowing oil in 1½ hours, recovering 1,800 ft. of 36°-gravity pipe-line oil, with 1,900 lb. bottom-hole pressure open and 2,700 lb. closed. Test at 6,982-87 ft. recovered salt water. This well also had tested oil in the Slick sand, getting a recovery of 660 ft. of 35°-gravity oil and 90 ft. of oil-and-gas-cut mud, with no water, bottom-hole pressure 660 lb. open, 2,500 lb. closed, at depth of 6,682-88 ft. Salt water was tested just below at 6,690-96 ft. Operators drilled ahead to the 8,500-ft. contract, where electrical log will be run. This test is located in the James Johnson Survey, Abstract 164, Tract 8.

Humble Oil & Refining Co. 1 John Tarlton, wildcat test which last week indicated a new gas field for Liberty County in the Sandune district 5 miles west of Hull field, has been completed as a dry hole. Total

depth 10,036 ft. An initial test below the 5½-in. pipe seat at 10,004 ft., and the total depth, failed to show commercially.

The name "Meyersville" has been given the new gas-condensate field opened by Continental Oil Co. 1 Fred Ruschaupt, 4½ miles south of Meyersville and about 1,400 ft. northwest of the Victoria County line, in DeWitt County.

There were 32 new locations reported this week, 6 being wildcats, 2 in Karnes and 1 each in Bee, Fayette, Harris and Refugio counties. Twelve of the 22 completions reported this week were oil, all in proven areas. Nine of the dry holes were wildcats, two in Karnes, and one each in Bee, Liberty, Live Oak, Matagorda, Orange, Refugio, and Wilson counties.

TEXAS GULF COAST WILDCAT FAILURES

Bee County: J. R. Dougherty and The Texas Co. 1 Oscar H. Ocker et al, in J. O. Taylor Sur., 5 mi. W of Mineral, dry, TD 7,514 ft.

Karnes County: J. A. Chapman 1 J. F. & Agnes Brysch, in Andres Hernandez Survey, 6 mi. E of Falls City field, dry, TD 4,050 ft.

Karnes County: Sunray Oil Corp. 1 Mrs. S. Choate, in Incarnacion Vasquez Sur., 3 mi. E of Burnell field, 7 mi. SE of Kenedy, dry, TD 4,011 ft.

Liberty County: Humble 1 John Tarlton, Tr., Sandune District, in Alex. Taylor Sur., 5 mi. NE of Liberty townsite, 4 mi. SE of Dandune townsite, dry, TD 10,036 ft.

Live Oak County: Henshaw Bros. and E. H. Smith and J. S. Abercrombie 1 W. A. Dunn, in Refugio County Sch. Ld. Sur. 7, 5 mi. SE of Oakville, dry, TD 9,433 ft.

Matagorda County: Skelly Oil Co. 1 Albert F. Gest, in H. Gosling Sur., 1½ mi. SE of East Bay City production, dry, TD 12,051 ft.

Orange County: Sun Oil Co. 1 Lutcher-Moore Lumber Co., in Jas. Dyson Lge., 1 mi. NW of production on Orange Dome, dry, TD 9,314 ft.

Refugio County: P. R. Rutherford 2 L. Zarsky, in John & Pugh subd. of Bonnie View Ranch, in Esteban Lopez grant, dry, TD 7,000 ft.

Wilson County: J. E. Mowinckle 1 Franklin Flato, in Vidal Ybarbo Sur., dry, TD 3,410 ft.

N. CENTRAL TEXAS

Baylor County Wildcat Being Drilled Deeper

WICHITA FALLS.—Deeper limestone production for Baylor County was indicated last week at Ashland Refining Co.'s wildcat, the 1 Lillie V. Martin, in Block 3,114, TE&L Survey. Location is 1 mile northeast of Westover, in the southeastern part of the county, and between the Mills and Rendham areas, where production ranges from 2,500-4,300 ft. in the Canyon and Strawn series of the Pennsylvanian. A showing of oil was found at 4,900-25 ft., in what has tentatively been called the Caddo limestone, and on a 1-hour drill-stem test it recovered 160 ft. of oil, 180 ft. of oil-cut mud, and 125 ft. of salt water. Operators were drilling deeper.

In Jack County, 3 miles northeast of Perrin, Deep Rock Oil Corp. 1 R. Thomas, recovered 30 ft. of oil and gas-cut mud and some free oil, in a 1-hour drill-stem test at 6,058-74 ft. in the Ellenburger. Total depth was 6,093 ft.

Fred M. Manning 1 A. W. Mueller, 4 miles southeast of Eolian, Stephens County, had total depth at 4,231 ft. in Ellenburger, topped at 4,212 ft. After acid treatment, it showed some oil and sulfur water; plugged back to 3,380 ft., perforated at 3,361-66 ft. in what has been called the Caddo, and flowed 78 bbl. of oil in 24 hours through ¼-in. tubing choke. Tubing pressure was 600 lb., casing pressure 1,050 lb. Operators continued testing. Top of the Caddo was placed at 3,293 ft.

Woodley Petroleum Co. last week applied to the Railroad Commission for a new field designation for its 1 A. L. Thorpe in the northwest quarter of Section 456, SPRR Survey, Stephens County. The 1 Thorpe made completion tests in the Mississippian limestone of 237 bbl. of oil a day. The company also announced reworking operations at its 1 G. W. Thorpe, offsetting the oiler to the northwest, and completed 3 years ago for 20,000,000 cu. ft. of gas a day at 3,605 ft. It blew out at that depth and operators decided against deepening. Oil pay is expected around 3,730 ft.

WEST CENTRAL TEXAS SUCCESSFUL WILDCAT

Brown County: G. C. English 1 F. H. Madison, Blk. 10, Juan Delgado Sur. 789, 4 mi. E Crosscutt, flowed 99 bbl. oil a day, 20 per cent water, 42° gravity, Caddo 2,266-82 ft., topped at 2,065 ft., GOR 2,950:1, tubing pressure 40 lb., casing pressure 400 lb., TD 3,400 ft., PB 2,284 ft., elev. 1,596 ft.

Throckmorton County: Fred M. Manning, Inc., 1 James R. Record, Sec. 1609, TE&L Sur., 5 mi. NW Woodson, flowed 360 bbl. 45°-gravity oil a day, Mississippian limestone 4,675-83 ft., TD 4,700 ft., TP 500 lb., CP 600 lb., GOR 500:1.

WEST CENTRAL TEXAS WILDCAT FAILURES

Callahan County: G. C. Tisdale 1 Ella Moore Seale, Blk. 27, Y. C. Yates Sur., 8 mi. SW Baird, dry, TD 1,250 ft. in shale.

Erath County: McCarthy Oil & Gas 1 Fannie Keeney, Sec. 201, R. M. Dechene Sur., 6 mi. SW Bluff Dale, dry, TD 5,568 ft., Strawn 504 ft., Caddo 4,185 ft., Ellenburger 4,685 ft., show of oil in El-

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lenburger but no results after acid treatment, elev. 1,226 ft.

Jones County: Alder Oil Co. 1 Walter Pope, Sec. 16, Blk. 2, SPRR Sur., 2½ mi. SW Anson, dry, TD 2,934 ft., Saddle Creek 2,348 ft., Flippen sand 2,410 ft., limestone 2,426 ft., elev. 1,781 ft.

Hedrick Oil Co. 1 J. P. Howle, Sec. 17, Blk. 16, T&P Sur., 4 mi. SW Hawley, dry, TD 2,531 ft., Saddle Creek 2,080 ft., Flippen limestone 2,125 ft., Gunsight 2,402 ft., elev. 1,667 ft.

E. H. Wahl 1 R. Meadows, W. T. Evans Sur. 1, 2½ mi. S Nugent, dry, TD 3,788 ft., Saddle Creek 1,720 ft., Flippen limestone 1,787 ft., Hope 1,965 ft., King sand 2,055 ft., Palo Pinto 3,305 ft., elev. 1,611 ft.

Stephens County: J. P. Lohan et al 1 Allar Co., Sec. 1,028, TE&L Sur., 1 mi. W Ivan, dry, TD 4,215 ft., Caddo 3,296 ft., Marble Falls 3,954 ft., elev. 1,246 ft.

Throckmorton County: F. A. Callery 1 W. B. Ewalt, Sec. 2331, TE&L Sur., 7 mi. SE Throckmorton, dry, TD 4,723 ft., Caddo 4,093 ft., Mississippi 4,725 ft., elev. 1,233 ft.

Fred M. Manning, Inc. 1 Hugh Dickie, Sec. 982, TE&L Sur., 1½ mi. NE Woodson, dry, TD 4,004 ft., Caddo 3,916 ft., perforated 3,936-41 ft., swabbed 7½ bbl. oil and 18 bbl. salt water in 24 hr.

Fred Manning 1 John R. Gober, Sec. 3, Day Land & Cattle Co. Sur., 5 mi. SE Throckmorton, dry, TD 4,821 ft., Caddo 4,136 ft., Mississippi 4,765 ft., elev. 1,330 ft.

Fred Manning 36 Jack McKnight, Sec. 1, DL&C Sur., 6½ mi. SE Throckmorton, dry, TD 4,208 ft. in limestone and shale.

Konrad Sztykgold 1 Viola Estridge, Sec. 3090, TE&L Sur., 6 mi. N Throckmorton, dry, TD 5,080 ft., Caddo 4,454 ft., Mississippi 5,015 ft.

NORTH CENTRAL TEXAS SUCCESSFUL WILDCAT

Archer County: W. T. Graham 1 R. Campbell estate, BBB&C Sur., A-36, 3½ mi. S Anarene, pumped 35 bbl. oil, pay zone 5,060-5,100 ft., TD.

NORTH CENTRAL TEXAS WILDCAT FAILURES

Jack County: Deep Rock Oil Corp. 1 R. E. Thomas, W. L. Argo Sur., 3 mi. NW Perrien, dry, TD 6,093 ft., Palo Pinto 450 ft., Marble Falls 5,168 ft., Ellenburger 5,844 ft., elev. 1,123 ft.

Wilbarger County: Lloyd Oil Co. 1 W. A. Bond, Sec. 19, H&TC Sur., 3½ mi. SW Tolbert, dry, TD 5,507 ft., Gunsight lime 3,365 ft., Palo Pinto 5,037 ft.

Vickers Petroleum Co. 1 B. F. Jackson, Sec. 3, Blk. 16, H&TC Ry. Sur., 2 mi. SE Tolbert, dry, TD 5,227 ft., Palo Pinto 5,090 ft.

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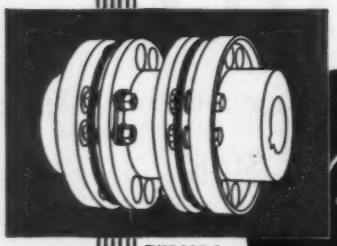

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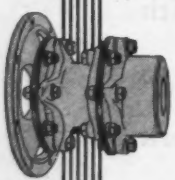

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APPALACHIAN FIELD

Production Curtailed Due To Heavy Snowfalls

PITTSBURGH.—The severe cold with attendant heavy snowfalls has seriously curtailed Pennsylvania Grade crude production in the lower eastern fields which will be reflected in the February totals for the entire Pennsylvania Grade area. Fortunately, sufficient available stocks were above ground due to the increase in production in 1946 to care for the average of better than 20 per cent decrease in runs from wells so that the heavy refinery demand could be met. With the advent of better working conditions and the incentive offered now by the announcement of a 16-cent advance, effective March 1, by the major purchaser of Pennsylvania Grade crude in West Virginia, it is expected that production totals will again resume an upswing. Another factor that will contribute to increased production is changes in ownership of rundown leases with direct management by the new owners who can profit only by increased production and are prepared to invest to do it. Several larger-than-ordinary transfers have recently been consummated.

In Baileysville district, Wyoming County, West Virginia, three wells were completed averaging better than 1,500,000 cu. ft. a day. Hope Natural Gas Co. completed 9,014 New River and Pocahontas Consolidated Coal Co. with final open flow, natural, of 1,525,000 cu. ft. of gas from the Berea; Maxon sand 2,005 ft., Big lime 2,725-3,150 ft., Berea 3,807-42 ft., gas 3,814-42 ft., total depth 3,844 ft. This company also completed 9,018, same lease, good for 1,870,000 cu. ft. of gas, natural, with the Berea 3,890 ft., gas 3,894--3,921 ft., rock pressure 750 lb. 14 hours, total depth 3,928 ft. Here, United Producing Co. completed 1,358 W. M. Ritter Lumber Co. with a gage of 1,400,000 cu. ft. of gas after acidizing the Big lime (2,661-3,112 ft.) with 1,000 gal., rock pressure 465 lb., total depth 3,112 ft.

These wells are in the huge reserves now being opened by several companies and a few independents, chiefly Hope Natural Gas Co., Godfrey L. Cabot, Inc., and United Producing Co. The area includes Raleigh and Logan counties where Columbian Carbon Co. is also active, as well as Wyoming County, with some wildcatting going on to the south and east. The field is now serviced by the new 53-mile 12-in. gas line of Hope Natural Gas Co. which now transports 33,000,000 cu. ft. of gas a day vitally needed in the area.

In Elk district, Kanawha County, United Fuel Gas Co. is drilling through the Oriskany sand in 5,760 Ego Gallati with the top gage so far of 2,862,000 cu. ft. of gas; surface elevation 1,164 ft., Corniferous lime 5,380 ft., Oriskany 5,507 ft., gas 5,515 ft., gas 5,533 ft. Litton and Radford topped the Corniferous lime at 5,565 ft. in the test J. A. Murdock, surface elevation 1,145 ft.

In Ripley district, Jackson County, Columbian Carbon Co. completed 930 John

E. Combs good for 1,494,000 cu. ft. of gas after shot with surface elevation 859 ft., Corniferous lime 4,892 ft., Oriskany 4,989 ft., gas 5.000 ft., shot 4,989-5,029 ft., total depth 5,063 ft.

In Clear Fork district, Raleigh County, Clear Fork Gas Co. completed 2 Charles C. Dickinson with a gage of 1,347,000 cu. ft. of gas, Weir sand, elevation 849 ft., total depth 2,361 ft. Here, Big Marsh Oil Co. completed 8 Rowland Land Co. with 600,000 cu. ft. of gas from the Weir, total depth 2,689 ft.

New locations totaled 11 and in Crook and Scott districts, Boone County; DeKalb district, Gilmer County; Ripley and Washington districts, Jackson County; Cabin Creek and Elk districts, Kanawha County; Hackers Creek and Skin Creek districts, Lewis County.

In Erie County, northwest Pennsylvania, Sylvania Corp. has staked a location for a test, 1 Frank Buczkowsky, and has the test 1 Alton F. Hugger drilling at 1,164 ft. This company recently completed the Oriskany gas discovery in Summit Township where the new work is under way.

New work consisted of seven locations in Patton Township, Allegheny County; Bethel and Valley townships, Armstrong County; Menallen Township, Fayette County; Amwell, Morris, and North Franklin townships, Washington County.

OHIO, KENTUCKY

Lorain Test Makes Good Gas Well

COLUMBUS.—Hanley & Bird's 1 Howard Hastings, Lot 46, La Grange Township, Lorain County, was drilled through the Clinton sand, 2,398-2,406 ft., to make a good gas well of 1,860,000 cu. ft. natural. The completion is a ½-mile extension to the upper La Grange pool.

Another gas well was drilled in in the north part of the pool in Bearfield Township, Perry County. J. B. Orndorff 1 Oscar Fleming (Holcomb), Section 15, was dry in the Clinton, 3,730-55 ft., and was drilled down to the Medina sand where it gaged 618,000 cu. ft. natural with 1,100 lb. rock pressure.

Another of the large Clinton sand gas wells was completed in Salt Creek Township, Muskingum County, ½ mile south of the Murphy. The well was drilled by B. G. Bartley on Nora Clewer, Section 28, and gaged 4,080,000 cu. ft. Top of the sand was found at 4,140 ft. and drilled to 4,152 ft. In the north part of the same township, Industrial Gas will drill the 1 M. J. Wickam down through the St. Peter sand for the second deep test in the township. The test will go to nearly 6,600 ft.

New locations reported have come back from a seasonal low of 10 to 23 for this week. Muskingum County reported eight, Stark five, Lorain three, and Ashland two. Completions also totaled 23 with Ashland in the lead with 5.

WILDCAT FAILURE COMPLETED IN OHIO

Columbiana County, Yellow Creek Township: O. Eberly 1 R. B. Falconer, Sec. 23, Oriskany 4,470-77 ft., TD 4,496 ft.

INDIANA

EVANSVILLE.—With no wildcat completions reported for the current week, interest in new development centers upon the H. E. Ledbetter 7 Steckler, NW NE NE 22-1s-12w, Knox County, a west outpost well in the Mount Carmel pool. A 1-hour drill-stem test at 2,271-85 ft., in the O'Hara, had gas in 4 minutes and a flow of clean oil in 48 minutes. A successful completion of this well will extend the Mount Carmel pool in a new direction.

WESTERN KENTUCKY

OWENSBORO.—Development work is at a low ebb. Completions for the current

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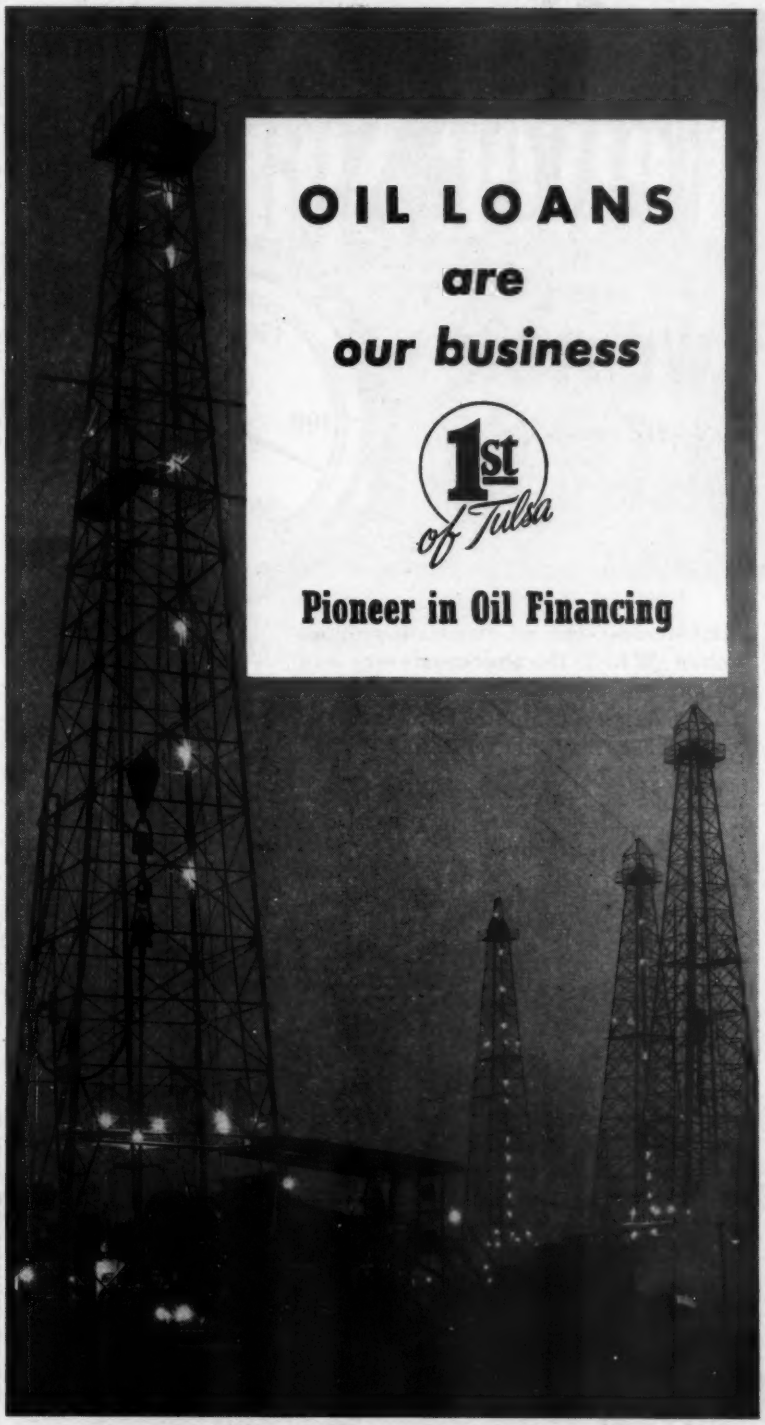

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week comprises two producers and four dry holes. Pure Oil Co.-Stanolind Oil & Gas Co. 1 G. Hammons, 2-H-67, Clay County, a wildcat test, has 7-in. set at 3,475 ft., total depth 3,640 ft., and is awaiting cable tools to drill out plug. Another wildcat test, R. T. Holtzclaw et al 1 Caventer, 9-M-29, McLean County, is drilling at about 600 ft.

EASTERN KENTUCKY

ASHLAND. — Three completions were noted in the eastern Kentucky field during the week, one of them near the 1,000,000-cu. ft. mark.

Kentucky-West Virginia Gas Co. completed wells. No. 827, J. S. Cline property, Pike County, 3,546 ft., 94,000 cu. ft. in shale, after shot; No. 5,703, D. D. Martin property, Floyd County, 2,740 ft., 103,000 cu. ft. in shale, after shot, and No. 5,719, L. D. Hinkle et al, Martin County, 912 ft., 989,000 cu. ft. in salt sand.

New locations were posted on the Matilda Clark property, Pike County; Wiley Tolliver, Knott County; William Hyden, Johnson County, and Adam Crum, Martin County.

CALIFORNIA

New Producing Area For Salt Creek

LOS ANGELES.—Independent Exploration Co. and Oceanic Oil Co. have made a new fault block discovery in the Salt Creek area of Kern County. Companies' 1 Roco, an outpost test southwest of Salt Creek production in 18-29s-21e, logged 150 ft of solid Carneros oil sand from 1,740 to 1,888 ft., and has cemented 7-in. casing at 1,740 ft. At this depth the Carneros is 600 ft. higher than in any other well in the Salt Creek field. Standard of California has staked location for No. 81-19w, an offset. Independent and Oceanic are preparing to drill a second well at an unannounced location.

The Carneros was found productive in the Salt Creek field just a year ago by Independent Exploration Co. Most of the wells since completed in this zone have been substantial producers of 20° oil.

Prospecting activity in the McKittrick-Cymric area to the southeast, has been noticeably on the increase in recent weeks. Latest wildcat location is Victor Exploration Co.'s proposed test on the southeast edge of the Cymric field in 32-29s-22e. At the southeast end of the McKittrick field in 28-30s-22e, Texas Co. is preparing to drill 28 Tulare Oil & Mining Co. The location falls about ⅛ mile east of the company's 1 West Pet, a discovery of last October which flowed 10,000,000 cu. ft. of gas on completion and has since been shut in. About 1 mile northeast, E. A. Parkford has just spudded 1 Parkford-McKittrick. A recent failure in the area is Wilshire Oil Co. 2 McKittrick in 12-30s-21e, abandoned at 6,691 ft.

Tests scheduled for next week may determine the outcome of Pacific Western Oil Corp. 1 National Royalties wildcat in 5-28s-22e, deepest hole in California. Operator is shooting the 5½-in. casing at 16,260 ft. for water shutoff. Top of the Wasco A-2 zone equivalent was logged at 16,100 ft.

Latest gage on Middle Dome Corp. 73-30V Eocene discovery on the Middle Dome of Kettleman Hills is 140 bbl. net of 39.5° oil, 59 per cent cut through a 20/64-in. choke. Water intrusion in this well and the acknowledged mechanical problems involved in drilling in this area have combined to lessen somewhat the enthusiasm which originally attended the completion.

In Ventura County, W. H. Geis is preparing to drill an Eocene test, 1 Robertson, near Bardsdale in 12-3n-20w. Impetus behind the project is the Milner Oil Co. 2 Dryden Eocene completion in this field. This well produced initially a few weeks

ago at the rate of 480 bbl. of 35° oil. Interest attaches to recent development work in this field because the first discovery was made here in 1891. The wells are notable for their slow rate of production decline.

General Petroleum Corp. is preparing to abandon 25,000 ft. of hole in the Buena Park area of Los Angeles County. The company's 1 Librown in 21-3s-11w, which was drilled in 1945 to 12,600 ft. and which has since been pumping a few bbl. of oil and water per day, is now on the idle list and preparations are being made to abandon. After the Librown well was drilled, the company started 46-1 LaMirada Community in Section 16 to the north. Drilled to 12,629 ft., the latter well has recently been undergoing tests which produced only a trace of oil. Abandonment is in prospect.

CALIFORNIA WILDCAT FAILURES

Los Angeles County, Santa Fe Springs area: Standard Oil Co. 1 Newsom Community, 36-2s-12w, dry, TD 10,319 ft.

Kings County, Pyramid Hills area: Buaas Development Co. 1 Deming, 29-24s-18e, dry, TD 3,103 ft.

Kern County, McKittrick area: Wilshire Oil Co., Inc., 2 McKittrick, 12-30s-21e, dry, TD 6,691 ft.

PERMIAN BASIN

Sun Test May Have Second Pay Section

MIDLAND.—Sun Oil Co. 1 Fred Jameson, south offset to the Jameson discovery, went out of the main body of Pennsylvanian Strawn pay at 6,352 ft., but found what may prove to be a second pay section at 6,453-96 ft. The first 213-ft. section had saturation in all but about 7 ft. of shale streaks above 6,352 ft. A drill-stem test at 6,453-96 ft., through ⅝-in. bottom-hole choke and ¼-in. top opening, brought gas to the surface in 11 minutes and attained a volume gaged at 509,000 cu. ft. of gas a day. Maximum working pressure was 350 lb. Total recovery was 270 ft. of clean oil, 360 ft. of salt water, and 120 ft. of gas-cut mud. Bottom-hole flowing pressure ranged from 500-950 lb., and shutin pressure increased to 2,700 lb.

Operators were of the opinion that the second pay section was still in the Strawn.

Preparations were being made to drill ahead to test the Ellenburger, expected between 6,850 and 6,900 ft.

Shell Oil Co., Inc., 1 Celia McCrea became the second producer in the new Nelson (Ellenburger) field in western Andrews County last week when it completed for 323 bbl. of oil in 24 hours. Flow was through open tubing following acid treatment between 10,460-494 ft., total depth. Two other offsets to the discovery have been failures. Shell 1 Elizabeth Pinson, ½ mile south and ½ mile west of the opener, was dry, as was Humble Oil & Refining Co. 1 Arthur Pinson, ½ mile south of the discovery.

In Crockett County, Shell 1 University, NW NW 21-39 University Lands, was cleaning out after flowing 8,000,000 cu. ft. of gas a day, with a spray of oil, from the Ellenburger at 8,040 ft. Gas developed with the well was swabbed down to 1,900 ft. off bottom, following two acid treatments. Flow was through 2-in. tubing with packer set at 7,871 ft. The 1 University, on an elevation of 2,564 ft., was said to be 84 ft. lower on the Ellenburger than Stanolind 1 GG University, SW NW 12-39-University Land, ¼ mile north and ½ mile to the east, which had no commercial oil in the Ellenburger.

Stanolind Oil & Gas Co. 1-TT University, SW NW 12-39-University Lands, ½ mile north of the 1-GG, was scheduled to be completed in the Ellenburger as a gas-distillate discovery. On a 5-hour test through perforations at 8,100-48 ft., it flowed 98 bbl. of distillate and 4,446,000 cu. ft. of gas, following a 1,500-gal. acid treatment. Operators were to treat with 5,000 gal. before further testing.

In northwestern Ector County, Humble 1-G R. S. Cowden, 1 mile south-southeast outpost to the Andector field, Section 1, Block 45, T&P Survey, completed for 152 bbl. of oil daily but was thought to define the field in that direction when it produced salt water when only 19 ft. into the Ellenburger. Total depth was 8,635 ft.

In Western Gaines County, 4½ miles northwest of the Doss field, Cities Service Oil Co. 1 T. S. Riley, was showing for possible production in the Clear Fork limestone. A 2-hour drill-stem test at 7,105-195 ft. recovered 2,610 ft. of oil and gas-cut mud. Oil was estimated at 34.7° gravity. There was no water. Bottom-hole pressure, after shut in 15 minutes, rose to 2,250 lb., and maximum flowing pressure was 400 lb. Previously a 2-hour test at 7,044-7,102 ft. recovered oil and gas-cut mud. Operators were drilling below 7,225 ft. in limestone on last report.

WEST TEXAS SUCCESSFUL WILDCAT

Ward County: New oil field, 2½ mi. NW Spencer field—J. W. Murchison 1 Mollie Spencer, Sec. 53, Blk. 34, H&TC Sur., flowed 72 bbl. 34.4°-gravity oil a day through ¼-in. choke, Yates 2,675-2,775 ft., TD 2,780 ft., GOR 500:1, tubing pressure 300 lb.

WEST TEXAS WILDCAT FAILURE

Crane County: Byrd-Frost et al 1 A. R. Eppenauer, Sec. 20, Blk. 6, H&TC Sur., 12 mi. NW McCamey, dry, TD 6,003 ft., Yates 1,100 ft., San Andres 2,100 ft., Clear Fork 3,090 ft., Simpson 5,260 ft., Ellenburger 5,855 ft., elev. 2,344 ft.

Texas Gulf Producing Co. 1 Rio Bravo Oil Co., Sec. 7, Blk. 31, H&TC Sur., 1½ mi. N Girvin, dry, TD 5,925 ft., Yates 970 ft., San Andres 1,970 ft., Glorietta

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Dawson County: Pringle, King, Warren & Dye 1 J. F. Steward, Sec. 105, Blk. M, ELRR Sur., 13 mi. W Lamesa, dry, TD 5,270 ft., anhydrite 2,150 ft., Yates 3,060 ft., San Andres 4,810 ft.

Garza County: Midland Oil Corp. 2 D. W. & J. H. Eubank, Sec. 15, Blk. 4, WCRR Sur., 14 mi. NE Post, dry, TD 3,250 ft., San Andres 2,012 ft., Glorietta 3,069 ft., elev. 2,475 ft.

Scurry County: M. H. Crabb 1 Harrie & Wade Winston, Sec. 35, Kirkland & Fields Sur., 3½ mi. NE Ira, dry, TD 1,915 ft. in limestone.

Ward County: Stanolind Oil & Gas Co. 1-B Sealy-Smith Foundation, Sec. 81, Blk. A, G&MMB&A Sur., 26 mi. W Monahans, dry, TD 6,510 ft., Yates 2,340 ft., Glorietta 4,820 ft., elev. 2,626 ft.

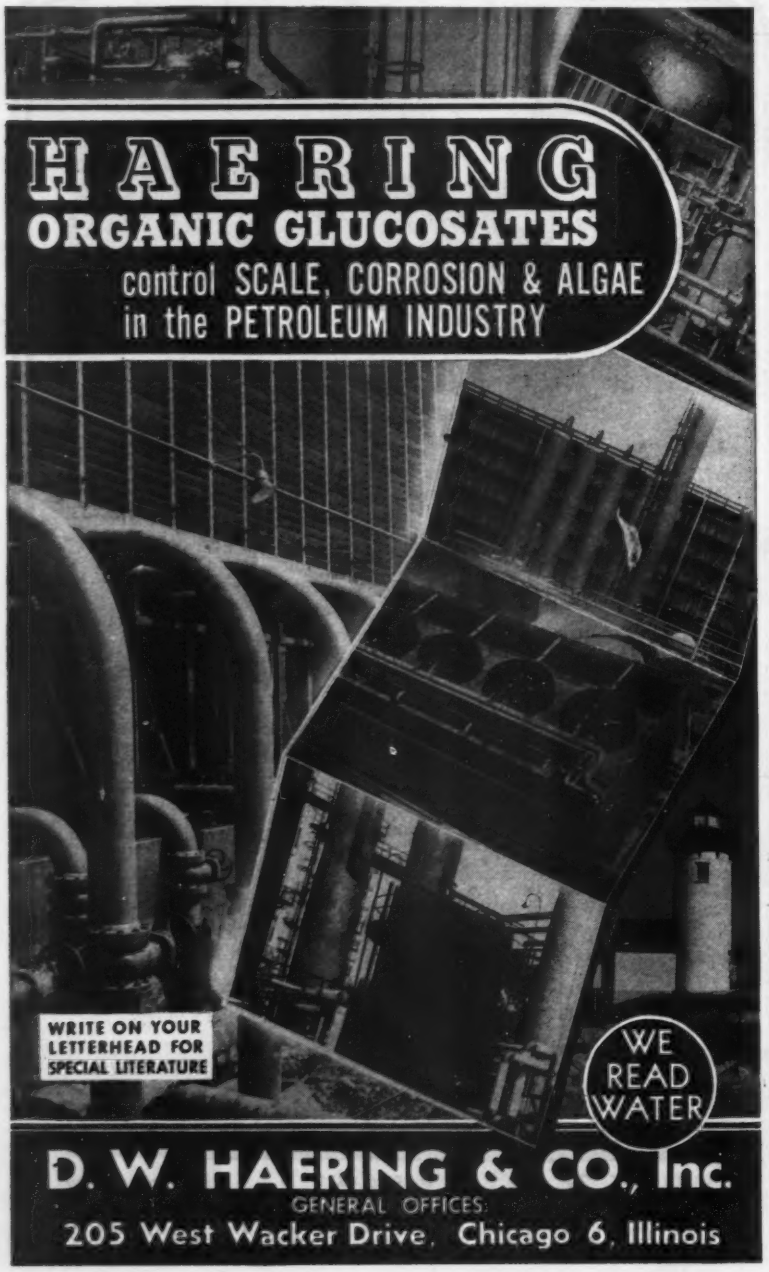
SOUTHEASTERN NEW MEXICO

HOBBS.—Richfield Oil Corp. 1 Comanche, 13-11s-26e, Chavez County, had total depth at 6,027 ft. in limestone and shale. A drill-stem test at 5,972-6,014 ft., open 1 hour, produced only a slight blow of air in 15 minutes. In Eddy County, Grayburg Oil Co. 13-B Keeley, 26-17s-29e, was drilling below 5,040 ft. in lime and sand.

In Lea County, The Texas Co. 1 Garrett, 22-16s-38e, plugged back to 5,690 ft. from total depth of 5,790 ft., and swabbed 96 bbl. of water and 24 bbl. of sulfur water. Page & Yates 1 Stroup, 10-18s-32e, was fishing tools at total depth 4,550 ft.

SOUTHEASTERN NEW MEXICO SUCCESSFUL WILDCAT

Lea County: New oil field—Devonian Oil Co. 1 Browne-Federal, NW NW 19-9s-38e, flowed 121 bbl. 25°-gravity oil and 20 bbl. water a day, 24/64-in. choke, San Andres 4,926 ft., TD 5,011 ft., tubing pressure 50 lb., casing pressure 750 lb., shut-in casing pressure 1,250 lb.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ROCKY MOUNTAIN

Mush Creek Pool Extended Northwest

DENVER.—The completion of a second well in the Mush Creek area, Weston County, northeastern Wyoming, flowing 300 bbl. of 41.7°-gravity crude oil in 24 hours, was reported in Mush Creek Production Co. 1 Asa Roberts, SW SE SW 10-44n-63w. It had the first Wall Creek at 2,615 ft., second Wall Creek at 3,020 ft., and the Greenhorn lime at 3,210 ft. The 7-in. was set on top of the first Newcastle sand at 3,998 ft. A 5-in. liner then was run to the top of the second Newcastle sand at 4,018 ft., and the well was completed at 4,032 ft. It flowed 21 bbl. first hour and 180 bbl. in 18 hours, and then was deepened 4 ft., flowing 300 bbl. of oil and 100,000 cu. ft. of gas in 24 hours. Elevation is 4,034 ft.

The well is located ¼ mile northwest of 2 Smith, the discovery, which was completed last December at 4,019 ft., and flowed around 125 bbl. per day. The sand in this area appears to be lenticular as was indicated this week when Morton Drilling Co. 1 State, NE NE NE 25-44-63, three miles to the southeast, was abandoned at 3,834 ft. as uncommercial. It had only 1 ft. of saturated sand, the Newcastle having shaled out.

Southeastern Colorado tests.—J. M. Huber Corp.-Frontier Refining Co. 1 Ingle, SW SW SE 27-29s-50w, Freezeout District, Baca County, southeastern Colorado, the third well drilled in search of a stratigraphic trap on the west side of the Anadarko Basin, was abandoned at 4,947 ft. in the Mississippian. Location for the next in the series has not yet been released. The operation is based on the evidence of a trap in a well drilled in 8-30-50 in 1928 by Marland Oil Co., which was abandoned in granite at 2,089 ft., the objective being absent.

Herrick Dome discovery.—Superior Oil Co. 1 Herrick, SW NW SE 1-16n-76w, Herrick Dome, Albany County, Wyoming, a discovery in the Tensleep at unreported depth, but around 3,600 ft., pumped 315 bbl. of 23.6°-gravity oil first 24 hours.

Kutz Canyon test.—Paul B. English and Byrd-Frost, Inc. 1 Government, C NW SW 4-27n-10w, Kutz Canyon shallow gas field, San Juan County, New Mexico, which a month ago recovered 3½ ft. of bleeding core from the top of the Dakota sand at 6,479-82½ ft., and looked like a discovery out in the San Juan Basin, is still in a stage of uncertainty. The first Dakota horizon had a lot of shale in the sand, and failed to come up to expectations. Approximately 135 ft. from the top it went into shale, and at 6,615 ft., after penetrating a hard thin stratum, hit a gas pocket which cleared the hole of 4,600 ft. of drilling mud with some oil. After the gas had expended itself the hole was deepend to 6,623 ft. when it was decided to make a drill-stem test. The test at 6,465-6,623 ft., open 12 hours, recovered gas in 13 minutes, estimated at 50,000 to 100,000 cu. ft., and 630 ft. of oil and gas-cut mud. Tubing was run for a swabbing test, but swab was lost, tubing was pulled, and fish recovered, and a second attempt is now under way. A comparison of the log of this well with wells at Barker dome, on the northwest, where the principal gas-producing horizon is in the second Dakota sand, is said to show that the Kutz Canyon well still has about 50 ft. of shale to drill before reaching the second bench of the Dakota.

Small well at Corley.—Continental Oil Co. 3 Van Noy, SW SW SE 34-44n-93w, Corley Dome, Hot Springs County, Wyoming, ½ mile northwest of a discovery in the Embar a year ago, tested lower horizons down into the Madison to 5,075 ft. without discovering anything of importance. It was plugged back to the Embar

and swabbed 35 bbl. of oil and 277 bbl. of water in 24 hours through perforations at 4,116-38 ft. The discovery and a second well between it and No. 3 are both showing considerable water, and the three wells about represent the area of the pool. The Tensleep at 4,340 ft., Amsden at 4,590 ft. and Madison at 4,875 ft. all carried water.

New operations.—Only seven new operations were reported, of which Colorado had two, Wyoming three, and Montana two. The Colorado locations were one in the Rangely field, and J. E. Dinger 1 Ute, NE NW NE 27-33n-12w, Red Mesa District, La Plata County, between the north end of the Barker dome and the Hudson-Coryell well at Red Mesa which is standing with considerable oil in the hole. Wyoming locations included one in Little Buffalo Basin and 2 in the Hamilton field. Montana had one new operation in Kevin-Sunburst and another in the Cedar Creek gas field.

Completions.—Twelve wells were completed, of which seven were oil wells, five were dry holes, including two wildcat failures in Colorado. Ten were in Wyoming, including three wildcats, all dry holes except one at Corley which was plugged back and completed in an upper horizon as a development well.

COLORADO WILDCAT FAILURES

Badito-Alamo, Huerfano County: Mid-Alamo Oil Co. 1 Bartlett, NE SW NW 27-27s-68w, TD 2,791 ft., dry and abd. Timpas 2,015 ft., 1st Dakota 2,508 ft., Morrison shale 2,720 ft., Morrison sand 2,782 ft.

Freezeout, Baca County: J. M. Huber Corp.-Frontier Ref. Co. 1 Ingle, SW SW SE 27-29s-50w, TD 4,947 ft., dry and abd. Top Pennsylvania 3,123 ft., Mississippian 3,952 ft.

WYOMING WILDCAT FAILURES

Corley, Hot Springs County: Continental Oil Co. 3 Van Noy, SW SW SE 34-44n-93w, TD 5,075 ft. in Madison, plugged back to Embar and completed as development well through perf. at 4,116-38 ft. for 35 bbl. oil and 277 bbl. of water. Tensleep 4,340 ft., Amsden 4,590 ft., Madison 4,875 ft., all water sands.

Manville, Niobrara County: Shell Oil Co. 1 Government, SE NE NE 29-35n-65w, TD 5,175 ft., dry and abd., upper Sundance 4,753, basal Sundance 5,073 ft., Spearfish 5,148 ft.

Sulphur Springs, Natrona County: K. S. Albert 1 Brewer, NW SW NW 33-36n-83w, TD 1,030 ft., Shannon 954 ft., dry and abd.

MISSISSIPPI

Amite County to Drill Ahead, After Testing

JACKSON.—Gulf Oil Corp. 1 J. A. Rowland, 39-4n-2e, Amite County, was expected to drill ahead after testing gas shows at 10,911-924 ft. Total depth was 11,567 ft. in shale, with 5½-in. casing set at 11,520 ft. Top of the Massive was reported at 11,468 ft., and the Comanchean at 11,513 ft.

In Marion County, Humble Oil & Refining Co. 1 C. Tullos, 12-1n-18w, was coring below 5,150 ft. in hard, sandy shale, after taking a drill-stem test at 4,358-77 ft. Open 2 hours and 13 minutes, it recovered 150 ft. of mud and 4,137 ft. of salt water.

In Jefferson County, 4-9n-2e, E. E. Fogelson and Phil E. Langlin were drilling below 7,305 ft. Gulf's 1 Major, 29-6n-11w, Jones County, had total depth at 9,016 ft. and was still fishing drill pipe.

MISSISSIPPI WILDCAT FAILURE

Washington County: Warren Petroleum & Tide Water 1 Leroy Percy State Park, C SE NE 8-15n-7w, dry, TD 5,504 ft.,

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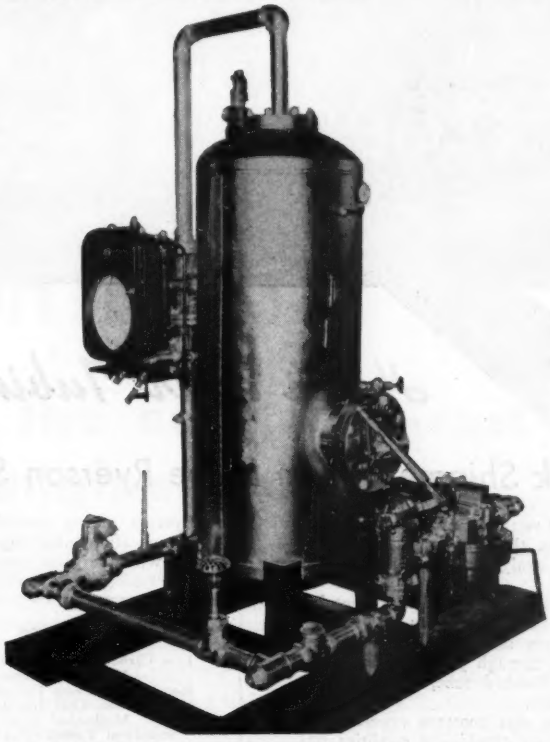

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slight show of oil 4,939-49 ft., no tops reported.

ILLINOIS

New McClosky Producer Near Bible Grove

THE NuEnamel Corp.-Gilliam & Aspin 1 Adams, SW NW SE 10-6n-7e, Effingham County, which last week reported 180 ft. of clean oil on a drill-stem test in the Rosiclare at 2,835 ft., had 970 ft. of oil and 60 ft. of oil-cut mud on a drill-stem test in the McClosky at 2,868-78 ft. On a swabbing test the well made 10 bbl. of oil per hour, which was from the water. The well is being put on the pump to test without having been acidized. This discovery is 2 miles northeast of the nearest production in the Bible Grove pool, productive area. Formations reported are: Menard at 2,174 ft., Glen Dean at 2,379 ft., Golconda at 2,448 ft., Barlow at 2,519 ft., Cypress at 2,568 ft., Paint Creek at 2,686 ft., Benoist at 2,698 ft., Renault at 2,756 ft., Aux Vases at 2,761 ft., and Rosiclare at 2,831 ft. Total depth is 2,878 ft.

New work continues to show a trend toward concentration in the border counties. Of 30 permits listed this week, 13 were in Wabash, White and Lawrence counties. Total permits were as follows: Wabash seven, White four, Clay, Hamilton, and Wayne three each, Clinton, Edwards, and Lawrence two each, Cumberland, Jasper, Jefferson, and Marion one each. Three of the permits were for deepening operations, one each in Cumberland, Hamilton, and White counties.

Active wildcat operations are at a low ebb, probably largely due to bad weather in recent weeks. A considerable increase in exploration drilling is anticipated in the next few weeks with the return of warmer weather.

ILLINOIS WILDCAT FAILURES

White County: N. A. Cummings 1 Walsh, SE SW NE 9-5s-10e, dry, TD 3,198 ft., Tar Springs 2,472 ft., Glen Dean 2,510 ft., Golconda 2,595 ft., Barlow 2,710 ft., Cypress 2,757 ft., Benoist 2,910 ft., Renault 2,994 ft., Aux Vases 3,019 ft., and McClosky 3,109 ft.

Coles County: Ernest Zink 1 Baker, NE NE NW 10-12n-9e, dry, TD 1,909 ft., Glen Dean 1,551 ft., Barlow 1,635 ft., Cypress 1,692 ft., Paint Creek 1,795 ft., Renault 1,830 ft., and Ste. Genevieve 1,861 ft.

Marion County: H. J. Schafly et al 1 Creed, SE SE SW 25-1n-1e, dry, TD 2,329 ft., Menard 1,581 ft., Tar Springs 1,708 ft., Glen Dean 1,807 ft., Barlow 1,972 ft., Cypress 2,021 ft., Benoist 1,161 ft., Renault 2,216 ft., Aux Vases 2,225 ft., Ste. Genevieve 2,326 ft.

Wabash County: Illinois Mid-Continent 1 Kurtz, NW NE SE 25-2s-14w, dry, TD 2,874 ft., Menard 1,942 ft., Tar Springs 2,096 ft., Glen Dean 2,242 ft., Golconda 2,335 ft., Barlow 2,447 ft., Cypress 2,468 ft., Paint Creek 2,599 ft., Renault 2,717 ft., Aux Vases 2,743 ft., Ste. Genevieve 2,781 ft., and Rosiclare 2,830 ft.

KANSAS

Burnett NW Pool Gets Northwest Extension

SUNRAY OIL CORP. 1 WILSON, SE SW SE 35-10s-18w, Rooks County, is a maximum Arbuckle well and extends the Burnett Northwest pool ¼ mile north and ¼ mile east. This is the third consecutive completion in the new field to be given a maximum potential.

One-half mole west of the abandoned Antonio pool, Lotus Oil Co. and Trojan Oil Co. 1 Feitz, NE NE SE 27-14s-19w, Ellis County, is a 132-bbl. pumper in the Arbuckle which was topped at 3,712 ft. Casing was set on top of the Arbuckle and hole was drilled to total depth of 3,718 ft. When plug was drilled out, the hole filled 1,200 ft. with oil and there was no show of water. The Antonio pool produced a small amount of oil from a single well and has long since been abandoned.

An open flow test gage of 23,800,000 cu. ft. per day from the Arbuckle, through perforations at 4,098-4,138 ft. in Cities Service 1 Becker, NE SE NW 32-23s-15w, Pawnee County, has aroused considerable interest. Lansing was reported at 3,582 ft., Viola at 3,910 ft., and Arbuckle at 4,023 ft. A drill-stem test in the Lansing at 3,609-40 ft. recovered 90 ft. of oil, 800 ft. of oil and gas-cut mud, and 1,230 ft. of water. Pipe was set at 4,175 ft. and perforated from 4,048-4,138 ft., or 25 to 115 ft. in the Arbuckle where the large gas flow was encountered.

Two of the seven wildcat operations reported the past week are conspicuously rank wildcats.

Cities Service 1 Snyder, C NW SE 18-28s-28w, Gray County, located 9 miles south and 21 miles west of Dodge City, is some distance east of the Hugoton gas field.

In Pottawatomie County, Dalton Wood 1 Meehan, NW NW SW 25-6s-9e, has set 12-in. surface pipe at 270 ft. and is drilling below 1,475 ft. This test is about 18 miles north and 33 miles west of the abandoned Wakefield oil pool in Clay County.

KANSAS WILDCAT FAILURES

Butler County: Baker & Yeager 1 Jones, NE NW NW 27-29s-3e, dry, TD 3,256 ft., Lansing-Kansas City 2,105 ft., Kansas City 2,362 ft., Mississippi lime 2,905 ft., Simpson 3,206 ft., Arbuckle 3,246 ft.

Cowley County: Deworth Hager 1 Long,

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NE NE SW 9-34s-5e, dry, TD 3,174 ft., Layton 2,352 ft., Mississippi lime 3,159 ft.

Ellis County: Sohio & Brunson Drilling 1 Schmidt, NE NE NW 22-15s-17w, dry, TD 3,635 ft., anhydrite 1,116 ft., Lansing-Kansas City 3,287 ft., conglomerate 3,549 ft., Arbuckle 3,603 ft.

Greenwood County: E. E. Sauders et al 1 Reising, SE SW SW 3-24s-11e, dry, TD 1,987 ft., Bartlesville 1,875 ft., Mississippi lime 1,964 ft.

McPherson County: W. M. Ebke 1 Voth, NE NW NW 1-21s-1w, dry, TD 3,612 ft., anhydrite 790 ft., Mississippi lime 2,983 ft., Viola 3,458 ft., Simpson dolomite 3,486 ft., Simpson sand 3,500 ft., Arbuckle 3,583 ft.

Meade County: Stanolind Oil & Gas 1 Rickers, SW SW NE 27-32s-29w, dry, TD 7,637 ft., Herrington 2,735 ft., Krider 2,765 ft., Winfield 2,810 ft., Lansing-Kansas City 4,455 ft., Mississippi lime 5,763 ft., Maquoketa 7,300 ft., Simpson shale 7,470 ft., Simpson sand 7,480 ft., Arbuckle 7,535 ft.

Pratt County: E. M. Swearer et al 1 Hoffman, SE SE SE 22-27s-13w, dry, TD 4,525 ft., anhydrite 715 ft., brown lime 3,787 ft., Lansing-Kansas City 3,804 ft., Mississippi lime 4,270 ft., cherty Viola 4,320 ft., Simpson 4,366 ft., Arbuckle 4,493 ft.

Swearer & Phillips Petroleum 1 Nicholas, SW SW NW 28-28s-13w, dry, TD 4,630 ft., Lansing-Kansas City 3,897 ft., Mississippi lime 4,382 ft., Kinderhook 4,403 ft., cherty Viola 4,432 ft. with slight stain of oil, crystalline Viola 4,465 ft., Simpson shale 4,475 ft., Simpson dolomite 4,480 ft., Arbuckle 4,577 ft.

Rice County: Helmerich & Payne 1 Russ, SE SE NE 36-21s-8w, dry, TD 3,880 ft., Lansing-Kansas City 2,964 ft., Basal Kansas City 3,332 ft., Mississippi lime 3,438 ft., Kinderhook 3,515 ft., sand 3,756 ft., Viola 3,760 ft., Simpson 3,776 ft., Arbuckle 3,855 ft.

Rooks County: Sohio & Rine 1 Desbian, NE NE NE 12-10s-20w, dry, TD 3,990 ft., anhydrite 1,647 ft., Lansing-Kansas City 3,478 ft., sandy conglomerate 3,736 ft., cherty conglomerate 3,882 ft., Arbuckle 3,964 ft.

Rush County: Skelly, Lion & Sunray 1 E. C. Dirks, NE NE SW 7-18s-16w, dry, TD 3,521 ft., Lansing-Kansas City 3,221 ft., conglomerate 3,497 ft., pre-Cambrian 3,518 ft.

LEGAL

U. S. DEPARTMENT OF THE INTERIOR, Bureau of Land Management, Washington 25, D. C. Notice is hereby given that sealed bids will be received until 1 p.m. Wednesday, March 19, 1947, for land described herein situated within the known geologic structure of the Compton field, N.M.P.M., New Mexico. This land is offered to qualified bidders of the highest cash amounts per acre as a bonus for the privilege of leasing the land under Section 17 of the leasing act of February 25, 1920 (41 Stat. 437, 30 U.S.C. sec. 181), as amended, as follows: T. 18 S., R. 27 E., sec. 5, W½SE¼, 80 acres. Royalties payable to the United States will be at the rate of 12½ per cent to 25 per cent for oil, and 12½ per cent to 16⅔ per cent for gas, in accordance with Schedule B in the lease form. Each bidder must submit with the bid one fifth of the amount bid in cash, or by certified check on a solvent bank, or by money order, made payable to the order of the Treasurer of the United States, and file the showing of qualifications to receive a lease, required under 43 CFR 192.42(b) and (c). The envelopes should be plainly marked, "Bid for lease, Compton field, New Mexico. Not to be opened before 1 p.m., March 19, 1947." No bids received after the hour fixed herein for submitting bids will be considered. The remainder of the bonus and the annual rental at the rate of $1 per acre must be paid and a corporate surety bond in the sum of at least double the amount of rental, but in no case less than $1,000 nor more than $5,000, must be furnished by the successful bidder prior to the issuance of a lease. The deposits of the other bidders will be returned upon acceptance of the successful bids. Bidders are warned against violation of section 59, U. S. Criminal Code, approved March 4, 1909, prohibiting unlawful combination or intimidation of bidders. The right is reserved to reject any and all bids. Fred W. Johnson, Acting Director.

OKLAHOMA

Lindsay Area In Spotlight

C. L. CARLOCK & RAY RYAN 1 Harrison, NE NW SE 25-5n-4w, McClain County, flowed 24 bbl. of oil per hour from the Bromide at 10,452-57 ft. on a 24-hour test and focuses attention once more on the Lindsay trend. Drilled to 10,711 ft., 5-in. was set at 10,707 ft. and perforated at 10,452-57 ft., in the Bromide, topped at 10,345 ft. Gas flow is estimated at 5,000,000 cu. ft. per day. Operators have killed the well and will perforate from 10,440 to 10,490 ft.

The nearest production to this test is the Bauman 1 Ainsworth, NE NW SE 26-5n-4w, 1 mile to the west, which is producing from the Hunton at 9,892-9,994 ft. The North Lindsay pool about 3 miles northwest, which was discovered in 1945, produces from the Bromide.

Plymouth 1 Gibson, SW SE SW 14-5n-4w, McClain County, adds the Hunton as a new producing zone in the North Lindsay pool, which was opened in 1945 with Bromide production at about 10,995 ft. After drilling to 11,571 ft., the well was plugged back to 10,250 ft. in the Hunton, which was topped at 10,150 ft. Pipe was perforated from 10,145 to 10,190 ft. After acid treatment of 5,000 gal. the well flowed 110 bbl. of 44°-gravity oil per day.

The discovery well at North Lindsay, Cities Service et al 1-A Lawson, SW NW 22-5n-4w, was deepened 145 ft. and recompleted good for 642 bbl. per day, flowing

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through chokes. New total depth is 11,140 ft.

Midway between the Edmond and West Edmond pools, J. J. Fleet 1 Patten, SE SE NE 26-14n-4w, Oklahoma County, is opening a Bartlesville producing area. Bartlesville was found at 6,404 ft. and Hunton at 6,555 ft. Before testing the Bartlesville, the well was drilled to 6,610 ft. After shooting the Bartlesville with 80 qt. the well flowed 67 bbl. of 40.3°-gravity oil in 24 hours.

Gulf Oil Corp. 1 Bliss, SE NW NE 26-17n-1e, Logan County, is conditioning hole to run casing after a drill-stem test in the Wilcox at 5,176-93 ft. recovered 200 ft. of oil and gas cut mud and gas estimated at 130,000 cu. ft. First Wilcox was logged at 5,061-5,186 ft. Total depth is 5,193 ft. in sand.

The Tribbey North pool in Pottawatomie County, a 1946 discovery in the second Wilcox, got a new pay zone in the Hunton when Continental Oil Co. 1 Rosebush, SE NE NW 19-8n-2e, after failing in the second Wilcox, was plugged back, pipe perforated at 5,390-429 ft., and acidized with 1,500 gal. The well flowed 57 bbl. in 5 hours, then swabbed 70 bbl. in 21 hours with 3,000 ft. of oil in the hole. Hunton top was called at 5,390 ft.

OKLAHOMA SUCCESSFUL WILDCATS

Hughes County: Frank B. Murta 1 Wahl, NW NW NE 13-7n-9e, pumped 30 bbl. 36°-gravity oil per day from Booch at 2,940-50 ft., Calvin 1,025-50 ft., with a show of oil, brown lime 2,640 ft., sandy shale 2,929 ft., TD 2,960 ft.

Oklahoma County: John J. Fleet 1 W. S. Patten, SE SE NE 26-14n-4w, flowed 67 bbl. 40.3°-gravity oil per day by heads from Bartlesville at 6,403-43 ft.; Oswego 6,162 ft., Hunton 6,532 ft., Sylvan 6,574 ft., TD 6,610 ft.

Osage County: A. G. Oliphant 1 Osage, SW SW NE 1-25n-4e, pumped 35 bbl. 41°-gravity oil per day from Mississippi chat at 3,328-45 ft.; Oswego 3,00-98 ft., TD 3,351 ft.

OKLAHOMA WILDCAT FAILURES

Alfalfa County: Sunray Oil Corp. 1 Pike, C NE SE 24-25n-9w, dry, TD 6,750 ft., Layton 4,958-5,052 ft., Big lime 5,220-40 ft., Oswego 5,395 ft., Kinderhook 6,333 ft., Misener 6,452 ft., Hunton 6,465 ft., Sylvan 6,470 ft., Viola 6,545 ft., Simpson dolomite 6,548 ft., 2nd Wilcox 6,690 ft.

Cotton County: Bridwell Oil Co. 1 Berendzen, NW SW SW 25-1s-11w, dry, TD 3,296 ft., sand 2,360-67 ft. with slight stain of oil and 2,479-81 ft. with slight stain of oil, Canyon 2,980 ft.

Clark-Cowden 1 Corley, NE NE SE 30-3s-13w, dry, TD 2,750 ft., limy sand 1,960-2,050 ft., conglomerate 2,060-70 ft., sand 2,200-28 ft.

L. H. Choate et al 1 Ward-Foster, NW SE SW 33-3s-11w, dry, TD 1,811 ft., sand 1,495-1,515 ft. with show of oil.

Jefferson County: Bell Oil & Gas Co. 1 Trout, SW SW SW 9-7s-6w, dry, TD 3,114 ft., conglomerate sand 568-96 ft., sand 1,959-2,015 ft., 2,127-32 ft. and 2,139-55 ft.

Payne County: Mid-West Drillers and J. J. Wright 1 Rose Finnell, C NW SE 30-19n-1w, dry, TD 5,636 ft., Layton 4,038 ft.

Tillman County: W. C. Estes 1 Riggs, NE NE SE 2-1n-18w, dry, TD 984 ft., Granite Wash 640 ft.

LEGAL

DEPARTMENT OF THE INTERIOR, Wind River Indian Agency, Fort Washakie, Wyoming, March 4, 1947. Notice is hereby given that SEALED BIDS will be received until 2:00 P.M. April 4, 1947, at the Wind River Agency, Fort Washakie, Wyoming, for the leasing of Tribal land, for oil and gas mining purposes, located in Fremont County, Wyoming, described as follows: SE¼NW¼, SW¼NE¼, and E½SE¼ of Section 7; S½SW¼ and SE¼ of Section 8; N½NE¼ of Section 17; W½ of Section 16; and E½NW¼NW¼ of Section 21, all in Township 3 North, Range 1 West, W.R.M. The above described unit involving 820 acres of land will be sold as one lease to be drawn on the applicable government form. The right is reserved to reject any and all bids in the discretion of the Secretary of the Interior. The successful bidder will be required to pay the cost of advertising. The lease will be sold to the highest bidder for a bonus offer upon an acreage basis in addition to the royalty of 12½ per cent. Each bidder must enclose a certified check or bank draft drawn upon a solvent bank in an amount equivalent to at least 20 per cent of the bonus bid plus 20 per cent of the first year's rental at the rate of $1.25 per acre per annum, as a guaranty of good faith. The checks are to be made payable to the TREASURER OF THE UNITED STATES. The lease must be completed and filed with this Office within 20 days from the date it is received by the successful bidder for execution and accompanied by payment of the remainder of the bonus bid, the balance of the first year's rental and the filing fee of $5.00. Failure in any of these conditions may subject the bid to cancellation without further notice and forfeiture of payments already made. The lease issued as a result of this sale will contain the usual unit operation stipulation to the effect that within 30 days of demand to subscribe to and operate under such reasonable cooperative unit plan for the development and operation of the area, field or pool embracing the lands included herein as the Secretary of the Interior may determine to be practicable or necessary and advisable which plan to adequately protect the rights of all parties in interest, including the United States. The lease to be issued for the described unit of Tribal land will be made for a term of 10 years and as much longer thereafter as oil and/or gas is produced in paying quantities in accordance with the provisions of the Act of May 11, 1938, (52 Stat. 347) and the regulations approved May 31, 1938, Title 25, Code of Federal Regulations, Part 186. The rate of royalty will be 12½ per cent of the value of all oil, gas, and/or natural gasolines unless the lessor, with the approval of the Secretary of the Interior elects to take royalty in kind. The adequacy of the bonus offers will be determined by the Geological Survey. A suitable bond will be required and such bond must be approved by the Department. The responsibility of complying with any requirements of the Federal Documentary Stamp Statutes will be left with the successful lessee. All bids should be addressed to the Superintendent, Wind River Agency, Fort Washakie, Wyoming, in a plain envelope, marked: BID FOR OIL AND GAS MINING LEASE. STEAMBOAT BUTTE FIELD. TO BE OPENED 2:00 P.M. April 4, 1947. For further information call or write Mr. Waller, Land Division, of the Wind River Agency. J. M. Cooper, Superintendent.

LEGAL

CALL FOR BIDS. To sell royalty crude oil accruing to the United States. Sealed bids, in duplicate, will be received in the office of the Director of the Geological Survey, Room 5244 Federal Works Agency Building, Washington 25, D. C., on or before noon, March 11, 1947, for the sale of royalty oil accruing to the United States from Federal lands in the Kettleman North Dome field, California. No bid received after the time fixed for submitting bids will be considered. Contracts for the royalty oil will be for a term of 3 years beginning the first of the calendar month following execution by the Secretary of the Interior. The monthly royalty accruals offered for sale amount to about 60,000 barrels of unitized oil with an average gravity of about 37° A.P.I. Bids may be submitted on either one-half (Item 1) or on all (Item 2) of the royalty oil, or on both Items, as provided in the specifications. Specifications on the quantities of crude oil offered for sale, the form of bids, the form of contract, and the conditions with respect to bond requirements, deliveries, volume measurements, gravity determinations, and other details relative to the call for bids may be obtained by bidders from the Director, Geological Survey, Department of the Interior, Washington 25, D. C., or the Oil and Gas Supervisor, U. S. Geological Survey, Room 533, U. S. Post Office and Courthouse, Los Angeles 12, California. Sealed bids must be submitted to the Director of the Geological Survey, Department of the Interior, Washington 25, D. C., pursuant to the specifications, the envelope to be marked plainly "Bid on Kettleman North Dome Royalty Oil, not to be opened before noon, March 11, 1947." Oscar L. Chapman, Acting Secretary of the Interior.

Hunt Denied Higher Lisbon Gas Allowable

BATON ROUGE.—Louisiana Conservation Commissioner Joseph L. McHugh, last week declared he would make his decision on the Lucky field gas controversy "within 2 or 3 days." At the same time he turned down the application by Hunt Oil Co. for an increased allowable of 15,000,000 cu. ft. of gas daily from the Lisbon field in Lincoln Parish.

The Lucky field case began several weeks ago when McHugh canceled an allowable permit for Hunt to produce and sell gas from the field to the Tennessee Gas & Transmission Co. for export to eastern industry via the Little Big Inch pipe line on the grounds that it was contrary to the administration's stated policy.

In denying the application for additional gas, McHugh said, "Order 9-B, issued May 14, 1945, by the Department of Conservation, requires that the presently producing reservoirs in Northeast Lisbon field and Liston field shall be produced so as to result in efficient extraction of liquid and liquefiable hydrocarbons. This (Hunt's) application constitutes a violation of the order and of Act 157 of 1940, and also amounts to physical waste forbidden by the act."

Lucky field, not included in the March allowables, was considered a special case and the commissioner has 30 days from the February 10 hearing in which to decide on Hunt's application for 55,550,000 cu. ft. of gas a day from the field.

Meanwhile, a transcript of records of the state District Court case, in which the commissioner was denied an injunction to prevent removal of natural gas from Lucky field in Bienville Parish, was given to the Louisiana Supreme Court. January 29, Judge Robert J. O'Neal had recalled the restraining order issued against the H. L. Hunt interests and others. No date was set by the high court for argument on the case.

Canada's Crude Output Shows Slight Increase

OTTAWA.—Crude-oil production in Canada during November averaged 20,661 bbl. daily, a slight increase over October's daily average output of 20,620, according to a report of the dominion's Bureau of Statistics.

Total November production was 619,832 bbl. against 639,222 bbl. in October. Production in November 1945 was 652,081 bbl.

•Canada's November natural-gas production was 176,437,867 cu. ft. daily, a considerable increase over October's average daily production of 140,785,000 cu. ft.

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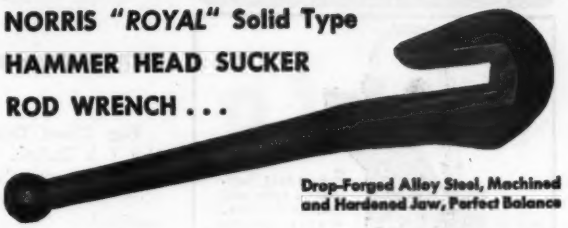

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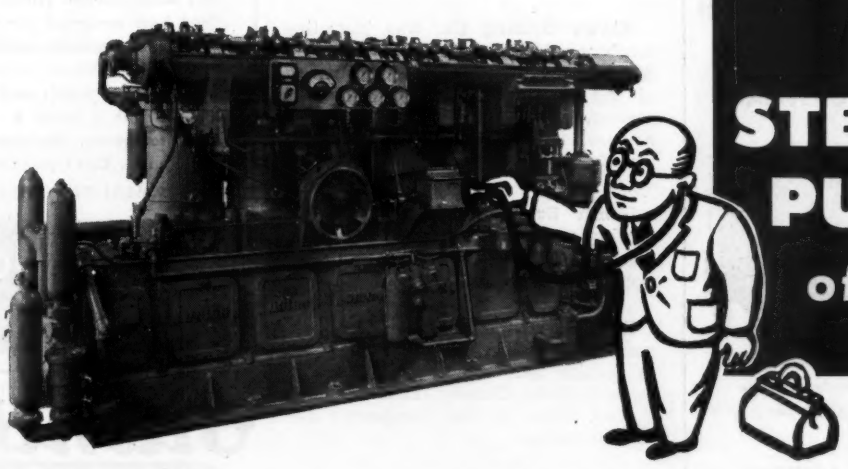

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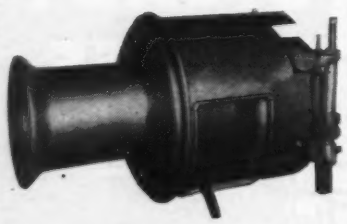

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Among the Drilling Contractors

Big Chief Drilling Co. has staked the 1-A Baker, in lot 164 of Section 36-6n-2w, on the south side of La-Grange field, Adams County, Mississippi.

Seran Drilling Co., Okemah, Okla., is drilling contractor on the Cities Service Oil Co. 2 Armstrong, in NW NW SW 23-12n-8e, Okfuskee County, Oklahoma. Contractor was moving in rotary tools.

Northern Development Co. of Edmondton, Alta., is starting work on L. & V. 1 (formerly Van Lloyd 5) in SE LSD 10, 2-49-28w3 in the Saskatchewan section of the Lloydminster field, Canada.

Smith-Horton Drilling Co. and Fred Haddock were spudding at their 1 Brown, in NW SW SE 12-7n-7e, Seminole County, Oklahoma. This is an outpost test between the West Fish and Wewoka pools.

Kiowa Drilling Co. was installing machinery for the 1 Brucker, in SE SE NW 26-19-1, ¾ mile northwest of the North Bitikofer pool on the eastern edge of McPherson County, Kansas. Location is 2 miles east of the Canton pool.

Smith Brothers Drilling Co. was rigging up rotary for its 1 Burns, in SE NW SW 4-7n-3e, Pottawatomie County, Oklahoma.

Ray Harris, Dallas, has the contract on the Sun Oil Co. 1 Jameson, in Section 253, Block 1-A, of H&TC Survey, Coke County, Texas. This is a west offset to the company's discovery well.

Mohawk Drilling Co. was moving in rotary to start its contract on the Charles Mee 1 Smith, in SW SE SW 5-7n-7e, Seminole County, Oklahoma.

J. S. Montgomery, contractor, was rigging up rotary at the Carter Construction Co. 1 Gates, in SW SW SW 23-9n-5e, Seminole County, Oklahoma.

Bennett & Roberts, drilling contractors, have completed a fishing job at the Sam K. Peck 1 Roy, in SW SW NE 14-8-20, an exploratory test 6½ miles northwest of the Webster pool in Rooks County, Kansas,

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and are drilling ahead. The contractors have an interest in the test, which is being supported by Continental Oil Co., Amerada Petroleum Corp., and Skelly Oil Co.

Jack McClure Drilling Co., Oklahoma City, has been granted an Oklahoma charter, with capital stock of $25,000. Incorporators are Jack H. McClure, Phil A. Cornell, and Edward Spiers, all of Oklahoma City.

Derby Drilling Co. and Sohio Petroleum Co., drilling the 1 Gorham Estate, in NW NE 7-13-15, a wildcat test 1 mile east of the Fairport pool in Russell County, Kansas, are drilling ahead below 1,900 ft.

J. E. Gray, Wichita Falls, Tex., has drilling contract on the J. P. Morgan 1 G. W. Biles, in NE NE SE 33-2n-16w, southeast of Snyder on the Kiowa-Tillman county line, in Oklahoma. Operator expects to drill to the granite.

Virginia Drilling Co. has started operations at the 1 Thul, in NW NW NE 23-21-12, an attempted ½-mile east extension to the Saundra pool of Stafford County, Kansas. The company opened the Saundra pool last November at the 2 Roberts, in CWL SW SW 14-21-12.

Lee Drilling Co., Tulsa, has extended its term of existence 20 years. Incorporators are F. L. Dunn, Kathryn Dunn, and Floyd McConnell, all of Tulsa. Capital stock is $20,000.

Sawyer Drilling Co. has staked location for a semiwildcat for The Texas Co. at its 1-A State, in SE SE 16-16s-38e, Lea County, New Mexico. Location is about 7 miles northeast of the Lovington field.

Olson Drilling Co. has 12,500-ft. contract on the Shell Oil Co., Inc., 1 Joe Walters, in C NE SW 14-10n-21w, wildcat 4 miles south of Elk City, in Beckham County, Oklahoma. Drill-stem test was being made last week.

Guy Mabee Drilling Co., Midland, Tex., was reported preparing to start drilling shortly on a 5,500-ft. wildcat in central-southeast Hockley County, Texas, about 8 miles southeast of Levelland. The prospector will be 1 W. L. Elwood, and probably will be located 440 ft. from north and west lines of Labor 18, League 19, Wichita County School Land Survey, Abstract 143.

Iron Drilling Co. has staked the 1 Allen, in SW NW SE 11-6n-8e, in the Spaulding area of Hughes County, Oklahoma.

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PERSONALS

Continental's West Coast Production Under Veteran

TWENTY-FOUR years of service with Continental Oil Co. in the United States and Canada prepared Charles R. Allen for his new post as regional production manager in California for the company.

Allen joined Continental as an accountant in 1923—4 years after being released from the Army as a captain. After working a while in Tulsa, he was transferred to the company's subsidiary, Hudson's Bay Oil & Gas Co., and stationed in Edmonton, Alta.

He spent 5 years there before being transferred to Fort Collins, Colo., as district production superintendent. Later he was transferred to Hobbs, N. M., in the same capacity, and after that assignment was named district superintendent in the Illinois basin. In 1944 he was made division superintendent, and on March 1, 1946, became proration engineer for the company, a position he held until his recent appointment in California.

C. R. Whitehill, assistant to the superintendent of transportation for Gulf Oil Corp. in Houston, will leave about April 1 for Kuwait to take charge of all transportation activities for Gulf Exploration Co. He has been with Gulf in Houston for the past 17 years.

Clifford L. Wise has been appointed plant superintendent of Fen-Ter Refining Co., Wynnewood, Okla., succeeding **L. S. Moxley,** who recently resigned. In other changes, **Larry May** was named assistant superintendent and **Joe Brickhouse,** blend foreman.

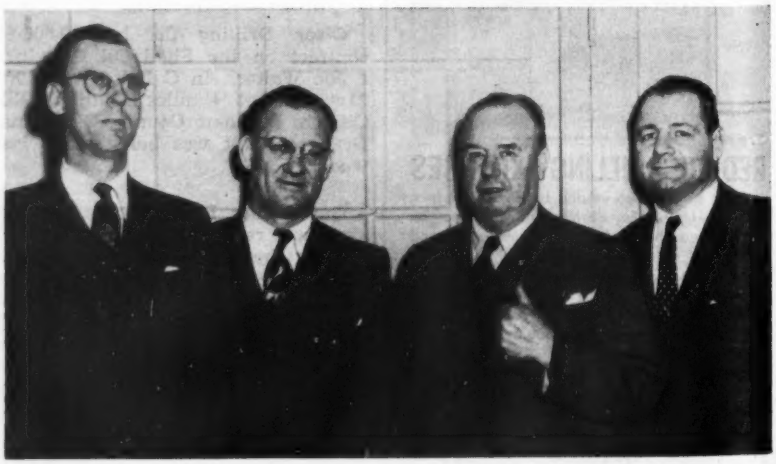
A. Crossley Smith, senior chemical engineer, has been promoted to principal chemical engineer in the reserch and development department of Atlantic Refining Co. Other department promotions include: **Sydney Mann** and **George P. Masologites,** both from associate chemical engineer to senior chemical engineer, and **William R. Turner,** from assistant to associate chemical engineer.

William B. Campbell, recently released with rank of major from the Army Air Forces, with which he served as a combat observer for the general staff, has been named general sales supervisor for Sperry-Sun Well Surveying Co., with headquarters in Houston. Before the war Campbell was sales promotion and advertising manager and export manager for Dowell Incorporated, Tulsa. He entered the oil business as general sales manager of Philfuels Co., subsidiary of Phillips Petroleum Co., and later was an independent operator.

W. M. PECK

William M. Peck, division manager of the Michigan producing division of Pure Oil Co., will succeed **John D. McNutt** on his retirement April 1 as Southwestern division manager of the company in Tulsa. Peck joined Pure as a roustabout in the Seminole, Okla., field. In 1929, he became assistant division land agent for Pure in Fort Worth and in succeeding years held positions of increasing importance in the company. He was assistant manager of the Southwestern division in Tulsa before he was moved to Michigan in 1943. **Worth M. Saxon,** now chief production engineer in Tulsa, will replace Peck in Saginaw. McNutt, with Pure since 1913, has been manager in Tulsa for 16 years.

Charles H. Dresback, now with Western Gulf Oil Co.'s geophysical department, is slated to become assistant manager and chief geologist of Colombian Gulf Oil Co. and leave for Bogota around March 15. He replaces Paul H. Boots who was killed early in February in a plane crash. Dresback has been with Gulf for 15 years.



Two representatives of Anglo-Iranian Oil Co., Ltd., were recent guests of the Petroleum Engineers' Club of Dallas. Above are S. W. Adey, Anglo-Iranian's New York office; Dewey A. Jordon, Atlantic Refining Co., Dallas, club president; J. A. Jameson, London, an Anglo-Iranian director; and John H. Murrell, DeGolyer & MacNaughton, Dallas

R. L. Clifton, manager of Carter Oil Co.'s production department, has retired from active service with the company. Clifton, who joined Carter in 1917 at Augusta, Kans., was in charge of production in the Oklahoma City field until 1936 when he was transferred to the Tulsa office. A series of other personnel changes, most of which result from Clifton's retirement, have been announced by Carter. While **R. J. Sullivan** will continue as assistant production department manager, **O. N. Knox,** Seminole, Oklahoma - Kansas division superintendent, will be moved to Tulsa to fill a new post as assistant general superintendent of the department. **Hugh R. Shannon,** formerly division superintendent at Billings, Mont., will succeed Knox. Carter will move its Oklahoma-Kansas division headquarters from Seminole to Oklahoma City in the next few months, and **H. L. Spiller,** engineer and production foreman at Seminole, will fill a new post of district production superintendent at Seminole. **Calvin L. Cooksey,** district superintendent at Plaquemine, La., will be shifted to the Northwest division at Billings. **A. E. Perry,** Seminole, has been made Seminole district gasoline superintendent.

R. L. CLIFTON

O. N. KNOX

H. R. SHANNON

H. L. SPILLER

J. L. N. Pollock, director in charge of public and employe relations, Anglo-American Oil Co., Ltd., a subsidiary of Standard Oil Co. (N.J.), is in the United States and plans to return to London sometime in April.

Reginald C. Rowley has been named foreman of the white-oil-inspection group in the chemical-products laboratory of the Bayway refinery of Standard Oil Co. of New Jersey. **Harry T. Rice** has been placed in charge of the experimental-white-oil group. In Bayway's operations analysis department, **John D. Graham** and **Wiljo M. Lindell** have been appointed group heads.

Harold H. Sexton, Houston Natural Gas Co., has been appointed operating superintendent of the Houston district.

Roger Harrold, Ohio Oil Co., has been elected president of the New Mexico Oil Scouts Association. Other new officers are **William W. Wilson,** Repollo Oil Co., vice president, and **E. H. Roberts, Jr.,** Drilling & Exploration Co., secretary-treasurer.

Fred S. Schwend has joined Warren Petroleum Corp. as an assistant to the executives of the liquefied petroleum gas division. A 1939 graduate of the University of Texas, Schwend since July of 1946 has been production manager of the petroleum butadiene section of Rubber Reserve. Before joining Reconstruction Finance Corp., he was with Phillips Petroleum Co. as process engineer for plants producing ingredients for synthetic rubber.

Shifts

C. C. Steward, engineer, Bechtel-McCone Corp., San Marino, Calif., to San Carlos, Calif.; **Ellis W. Hamilton,** engineer, Western Gulf Oil Co., Bakersfield, Calif., to Shafter, Calif.; **Warren E. Ten Eyck,** engineer, Bakersfield, Calif., to Long Beach; **S. B. Bean,** superintendent, Shell Pipe Line Corp., Colorado City, Tex., to Hobbs, N. M.; **E. Glenn Albright,** foreman, Atlantic Refining Co., Rockport, Tex., to Seminole, Tex.

C. J. Franz, foreman, The Texas Co., Pearland, Tex., to Tomball, Tex.; **M. H. Fawcett,** superintendent, Texas Water Wells, Inc., Weslaco, Tex., to Houston; **C. L. Wood,** foreman, Magnolia Petroleum Co., Luling, Tex., to Freer, Tex.; **Glenn M. Keeney,** foreman, Pleasanton, Tex., to Jourdanton, Tex.; **John H. MacDonald,** engineer, Magnolia Petroleum Co., Dallas to Tulsa.

H. F. Bachman, foreman, Sinclair Refining Co., Corpus Christi to East Chicago, Ind.; **J. T. Butterfield,** superintendent, Sun Pipe Line Co., Corpus Christi to Ingleside, Tex.; **Robert J. Holley,** engineer, Gulf Oil Corp., Crane, Tex., to Odessa, Tex.; **J. R. Montgomery,** engineer, Humble Oil & Refining Co., Houston to Refugio, Tex.; **W. J. Perlitz,** engineer, Neches Butane Products Co., Port Arthur, Tex., to Beaumont.

W. H. Humphreys, engineer, Cooperative Refining Association, Catlettsburg, Ky., to Ashland, Ky.; **L. G. Pope,** geologist, Carter Oil Co., Craig, Colo., to Mattoon, Ill.; **E. E. Clark,** engineer, Phillips Petroleum Co., Oklahoma City to Bartlesville, Okla.; **O. J. Jantz,** foreman, Amerada Petroleum Corp., Alexandria, Lt., to Houma, La.

Ernest D. Brockett, Jr., now assistant chief petroleum engineer for Gulf Oil Corp., Fort Worth, was honored recently by the Commonwealth of Australia with an award of the British Distinguished Service Order for his part in the combined-operations training of the Ninth Australian Division at Milne Bay and the initial landing and subsequent advance on Lae, New Guinea. Colonel Brockett was called to Washington to be cited and decorated by Alfred Stirling, Australian minister. He was accompanied by Mrs. Brockett and F. J. Adams, general agent, Gulf Oil Corp., Fort Worth. Since his graduation from Texas A. & M. College with a degree in petroleum engineering, he has been associated continuously with Gulf, except his 5 years service with the U. S. Army Engineers. Above are Brockett; Colonel Austin, Australian military attache; and Stirling

Sun Reports New Company Records For Operations in 1946

PHILADELPHIA.—Sun Oil Co. established new company records for crude-oil production and refinery operations in 1946, according to the annual report.

During last year, gross production reached approximately 33,000,000 bbl. or a volume equal to 57 per cent of the crude runs to stills at the company's refineries, the highest proportion of crude runs which Sun has recorded to date. In 1946, the company added gross proved reserves of 35,000,000 bbl., bringing Sun's total reserves to 650,000,000 bbl., or approximately 3 per cent of the national total, which is about the company's refinery throughput in relation to runs to stills for the United States.

Crude runs to stills at Sun's Marcus Hook and Toledo refineries totaled 57,890,728 bbl., or 446,467 bbl. more than the record set in 1945. Both refineries operated at an average of 93.3 per cent of their increased rated capacity.

Wells drilled and completed, including participation with others, totaled 411, of which 247 were oil producers, 53 gas wells, and 111 dry holes. Sun drilled 104 wildcats, with results showing 22 oil producers, 14 gas wells and 68 dry holes. At the year's end, Sun had in operation 2,386 oil wells in which it had 100 per cent interest, compared with 2,229 wells at the end of 1945. In addition, Sun had a part interest in 978 wells against 839 the previous year.

Among Sun's products, inaugurated during 1946, were jet-propulsion fuel. The U. S. Government-owned butadiene plant at Sun's Toledo refinery was shut down by a decision from Reconstruction Finance Corp. It produced about 40,000,000 lb. of butadiene for the wartime synthetic-rubber program.

On research, development, and engineering, the company spent $3,250,000 in 1946.

Sun's crude-oil tanker fleet totals 16. For additional tonnage needed, the company will charter tankers. Sun's crude-oil pipe lines total 1,205 miles, while its products are moved over the 853-mile lines of affiliated companies.

Sun's net earnings last year were $14,726,551 compared with $15,666,543 for 1945, to equal $4.17 a share for the 1946 period.

Tennessee Joins Compact Commission

The Interstate Oil Compact Commission enrolled its eighteenth member state when Gov. Jim Nance McCord of Tennessee signed the compact following passage of a bill by the Tennessee Legislature authorizing the action.

The compact was originally formed by six states in 1935. Besides the present 18 oil and gas-producing member states, the commission also has one associate member—Georgia—which has no production and is therefore ineligible for active membership.

Governor McCord named Paul Mathes, Tennessee conservation director as the state's representative on the commission.

In Austin, last week, the Texas Senate passed a bill continuing the authority of the state to participate in the compact for another 4-year period. Governor Jester had urged early action on the legislation.

The executive committee of the commission has scheduled a meeting in Oklahoma City March 8 which will be attended by Max W. Ball, director of the Oil and Gas Division of the Department of the Interior, and Alec M. Crowell, head of the production section of OGD.

At the March 8 meeting, the compact executive group will work out final arrangements for the quarterly meeting of the commission in Birmingham, Ala., April 24-27.

Paul Mathes, Tennessee conservation director; Tennessee Governor McCord, and Earl Foster, executive secretary of the Interstate Oil Compact Commission, as the governor signed the compact making Tennessee the eighteenth member

Crude Imports in 1946 At 244,411 Bbl. Daily

BOTH exports and imports of crude oil showed large increases in 1946 over 1945, according to figures compiled by the Bureau of the Census of the Department of Commerce. Imports of gas oil showed a considerable gain during the past year, while exports of the product showed an even larger drop.

A total of 89,210,000 bbl. of crude oil was imported during 1946, against an import figure of 74,128,000 bbl. in 1945, while crude exports in 1946 totaled 42,574,000, against 35,353,000 in 1945.

The accompanying table shows a comparison of daily-average imports and exports of last November and December and of 1946 and 1945:

EXPORTS
(In barrels daily).

	Dec., 1946	Nov., 1946	Entire year 1946	Entire year 1945
Crude oil	114,258	126,467	116,641	96,858
Gas and fuel oil	67,903	35,800	90,463	106,605
Motor fuel, gasoline	107,548	87,967	104,233	225,008
Lubricating oil	61,581	46,800	45,488	17,622

IMPORTS

	Dec., 1946	Nov., 1946	Entire year 1946	Entire year 1945
Crude oil	271,677	205,867	244,411	203,090
Gas and fuel oil	171,871	137,967	155,784	147,688

Baytown Property Sold

The sale to Humble Oil & Refining Co. of government-owned property at Humble's Baytown, Tex., refinery, including an office building, pipe lines, pumps, and miscellaneous equipment, has been announced by War Assets Administration in Washington. Purchase price was $93,000.

Equipment Men in the News

Superior Engine Opens New Orleans Office

R. E. HOFFMAN

Superior Engine Division of The National Supply Co. has opened a Southwestern regional office at 531 Gravier Street, New Orleans, according to an announcement by Robert M. Pearson, manager of sales. R. E. Hoffman, who has been manager of the division's office at Jacksonville, Fla., will be manager of the new regional office. J. F. Tucker, Jr., field service engineer for the oil-field machinery and equipment division, also will have his office at the new address.

$100,000 Plant Set for Lake Charles

Halliburton Oil Well Cementing Co., Duncan, Okla., has announced plans for construction of a new $100,000 plant on the river just north of Lake Charles, the site of Long-Bell Lumber Co. Land already has been purchased from Jacob A. Kushner. Preliminary engineering and survey work is now in process and almost immediate construction is planned. The building will be prefabricated and will be shipped for assembly. The $100,000 plant will serve as a bulk cement distributing center for the oil-field industry, with products to be delivered in bulk to oil-well sites, officials declared. All equipment will be mechanical, they added.

Combe Representative For Blackmer

L. S. Combe, head of Combe's Oil Equipment Co., Denver, has been named representative of Blackmer Pump Co., Grand Rapids, for the entire State of Colorado and part of Wyoming, it is announced by A. E. Jacobs, Blackmer vice president and sales manager.

Stone Joins Towmotor Sales Staff

Carl D. Stone, formerly connected with Braden Winch Co., Tulsa, has been appointed sales representative for Towmotor lift trucks in Oklahoma by Industrial Equipment Co., Kansas City. Stone assumed his duties January 1, with offices at 1244 South Toledo Avenue, Tulsa.

J & L Opens New Pauls Valley Store

Jones & Laughlin Supply Co. has opened a new store at Pauls Valley, Okla. William D. Breedlove, formerly with the company's Seminole, Okla., store, will be store manager, and will operate as part of the Central and Southern Oklahoma district under L. R. Roberts, district manager, Wewoka, Okla. R. A. Weber has recently been made field salesman in the Hutchinson, Kans., area.

Lyne in Middle East For Parkersburg

Joe A. Lyne, chief field engineer for Parkersburg Rig & Reel Co., Parkersburg, W. Va., left recently for the Middle East via London to cover operations in those areas in the interests of the company.

Ellis in South America

Earl G. Ellis, export service manager of Mid-Continent-Cummins Export Corp., 42 Broadway, New York, will leave in February for a 3-month trip covering all parts of Venezuela and Colombia in the interests of Cummins Diesel Engine Sales & Service in that area. He will visit all active drilling areas and supply such service as might be required by company equipment operating there.

B S & B Scene of Radio Program

Black, Sivalls & Bryson's manufacturing plant at Oklahoma City became a Columbia Broadcasting System studio January 18, when B.S.&B.'s Chief Engineer Gwynne Raymond, and D. I. Johnston, Oklahoma Associated Industries counsel, were featured in a discussion of income taxes on the program "Crossroads—U. S. A.." C.B.S. announcer Bill Downs interjected questions on the possibility of a 20 per cent reduction in personal income taxes to apply to 1947 income.

Corey and McDermond in Venezuela for Lacy

W. G. COREY

William G. Corey, oil equipment sales manager for Lacy Oil Tool Co., Los Angeles, is now visiting the various oil fields of Venezuela, surveying the market there for the Lacy Air Balanced oil well pumping unit. He is accompanied by C. C. McDermond, the company's sales representative, in that territory. Corey is expected back at his Los Angeles headquarters about March 25.

S.S.C. Acquires Control of American Exploration

Seismograph Service Corp., Tulsa, has purchased the controlling interest in American Exploration Co., Lafayette, La., it is announced by G. H. Westby, president of S.S.C. The management of American Exploration Co. will continue in their present capacities and field operations will continue to be conducted and supervised from Lafayette.

This latest addition to S.S.C.'s worldwide service organization adds another phase of seismic exploration to the company's activities. Westby said that American Exploration is particularly equipped and experienced in conducting marine exploration. The new subsidiary's activities are presently being conducted in the Gulf Coast of Texas and Louisiana.

Officers of the new subsidiary are J. E. Lee, Jr., president; L. F. Guseman, vice president and treasurer; and H. R. Conley, secretary.

American Exploration Co. is the sixth subsidiary of S.S.C., the others being Seismograph Service Corp. of Delaware; Westby Geophysical Corp.; Seismograph Service, Ltd.; Seismograph Service Corp. of Venezuela and Servicios Seismograficos de Colombia, S. A. This group has present operations in Venezuela, Colombia, Trinidad, Bahamas Islands, Mexico, France, Egypt, Iraq, and United States.

Fogle and Tweedie Appointed

Appointment of H. P. Fogle as assistant manager of the Gulf Coast division of Oil Well Supply Co., a subsidiary of U. S. Steel Corp., is announced by Paul H. Shepherd, division manager. The company's Gulf Coast division headquarters are located in Houston. Included in the announcement is the appointment of T. C. Tweedie as head of the subsurface department of the division.

E. W. Davis, president of Mid-Continent Supply Co., called over 120 division managers, store managers, and salesmen to the company's first postwar sales meeting. The conference was held at the Blackstone Hotel, Fort Worth, January 25-26, and was presided over by Frank John, assistant to Davis. Plans for the year were formulated and the company's new export setup was discussed

Classified Advertising

The Market Place for the Oil Industry

UNDISPLAYED

All ads except Situations Wanted, 10 cents a word. Minimum charge, $2.00 per insertion.
Situations Wanted ads, 5 cents a word. Minimum charge, $1.00 per insertion.
Centered Line, any ad, 75 cents.
Box Numbers count 9 words when replies are to be sent to our Tulsa Office. Replies forwarded without charge.

DISPLAYED, PER INCH

$9.00 per column inch per insertion. One-point border and 12-point capitals are allowed. Larger type sizes not accepted.

All classified advertising payable in advance.
10% Discount if 3 insertions are ordered at one time.
COPY DEADLINE, 9:00 a.m. Monday prior to each week's issue.

THE OIL AND GAS JOURNAL
P. O. Box 1260, TULSA, OKLAHOMA

EQUIPMENT FOR SALE

FOR CABLE TOOLS
see
DEGEN PIPE AND SUPPLY CO.
Box 107, Red Fork Station, Tulsa, Oklahoma

FOR SALE: Pumping Units. All types & sizes. New and used. Bridgeports, Jensens, Americans, Atlas, Ideco, with or without Power. Glenn Supply Co., 3600 Sand Springs Road. Phone 3-9607, Tulsa, Okla.

JUMBO D Fort Worth Spudder in A-1 condition with 15-inch to 6-inch tools, motors, and light plant; built-in Shear pole. Now drilling in deep test and additional contracts available. Good price on contract. Poor health requires selling on term contract coming up. Box B-611; The Oil and Gas Journal, Tulsa, Oklahoma.

FOR SALE: 5,000′ 4½″ OD 16.60# Range 2 drill pipe with regular tool joints; 6,100′ 4½″ OD 16.60# Range 2 drill pipe with A.P.I. F.H. tool joints. Also 1 steel drilling rig complete with boilers and drill pipe capable of drilling 6,000′. 7 Nixon Gas Lifts complete with weights, lifts and line Wire write or phone Louisiana Iron & Supply Co Shreveport, La.

EQUIPMENT FOR SALE

LUMBER FOR SALE: 3x6 and wider 10 to 16 rough Oak $58.00 f.o.b. mill. E. J. Gaiennie, Lumber, Box 1074, Shreveport, Louisiana.

FOR SALE: Allis-Chalmers Model "W" Skid Winch with Jerk line Spudder. Joe Williamson, 1201 East 6th St., Okmulgee, Oklahoma. Phone 249.

FOR SALE: Fort Worth "H" Spudder, steel pole with good cordage and drilling tools. Power No. 4600 Caterpillar Diesel engine. Frank F. Young, Chanute, Kansas.

FOR SALE: Complete small refinery with catalytic cracker, pipe line gathering system and production. Will sell complete or in part. Address inquiries to Box B-559, The Oil and Gas Journal, Tulsa, Oklahoma.

1 Caterpillar D-4 with Cardwell side boom. First-class condition. 1 T-D-9 International with Buchyeres Angle Dozer. New 1 Cleveland 110 Ditching Machine. First-class condition. W. B. Garner Contracting Co., Box 566, Turkey, Texas.

FOR SALE: Model 200 Sullivan Drill mounted on 1941 tandem White truck, complete with all drilling accessories, 1800 ft. 2⅞-in. drill pipe, 5x8 Gardner-Denver pump, Kohler light plant, etc. Purchased new in May 1945. Never drilled below 1,500 ft. Price $19,500.00, FOB Grandfalls, Texas. Write Box 172 or call 82, Grandfalls, Texas.

NEW MATERIAL FOR SALE

50—4″ x 25′ Barge Hoses equipped with Bronze Male & Female Couplings at $35.00 each.

Several thousand Victualic Coupling Gaskets, size 4″-6″-12″. 5,000 Gaskets for 8″ Single Lever Type Rapid Action Coupling Pipe at 50% Discount.

6—Centrifugal Pumps, unitized, 1000 G.P.M., powered by 33-R Continental 6 Cylinder Engine at $1250.00 each.

1—Water Purification System, 80 G.P.M. with Chemicals, Accessories, Wood Tanks, Fittings, and Valves. Semi-Portable, at $2500.00.

250—5¾″ Hughes Full Hole left hand A.P.I. Tool Joints, with A.P.I. Pipe Ends, 7″ O.D., 4″ bore, at $10.00 each.

Wire or Write
ATLAS SUPPLY COMPANY
P.O. Box 1331 Bakersfield, Calif.

EQUIPMENT FOR SALE

FOR SALE OR RENT: 8,000′ 4½″ A.P.I. Full Hole Drill Pipe. Melton Well Service, Seminole, Oklahoma.

FOR SALE: WAK. Waukesha engine, 180 H.P., completely overhauled. Box 1360, Phone 306. Seminole, Oklahoma.

FOR SALE: Diesel Engine powered rotary drilling rig, suitable for 5,000′ drilling. Priced cheap for quick sale. Phone 306. Box 1360, Seminole, Oklahoma.

FOR SALE: One Cardwell — Model R Spudder almost new, complete with tools, butane equipment and good lines. One 1945 model Autocar tandem with 11 x 24 rubber, almost new truck. One 2½ ton 6 x 6 complete with Tulsa winch & oil field bed, also new motor in truck. One T. D. 14 tractor complete with dozer & winch, this tractor in perfect condition. One low-boy trailer, good rubber. One float trailer, good rubber. One large short couple trailer for tandem truck, new rubber. One G.M.C. 1½ ton truck & trailer, 42 model, new rubber and in good condition. Telephone 237-J or Box 693. Grayville, Illinois.

1400′ 16″ O.D. 70# R. 1 P. E. CSG. USED FOR LINE A-1 CONDITION. LOCATED RODESSA, LOUISIANA.

ARTHUR ARNOLD
Phones 32414, 37948 P.O. Box 3003
Shreveport, Louisiana

FOR SALE

27,500′—1½″ OD .276″ Wall CD Seamless New PE Tubing, 6′ to 20′ RL, f.o.b. Akron, Ohio.

45,000′—2″ OD .120″ Wall CD Seamless New PE Tubing, 18′ to 20′ RL, f.o.b. Topeka, Kans.

RIGGS SUPPLY CO.
702 Union Nat'l Bank Bldg.
Ph. 5-4539—Wichita, Kans.

FOR SALE

TUBES and PIPE

all types and sizes

Write, wire or phone for quotations. Also motors, machinery and kindred items.

SONKEN-GALAMBA Corporation

Kansas City, 18, Kans.

FOR SALE

2—New Combustion Engineering Company Type V3M 3-Drum Marine and Industrial Type Bent Tube Boilers and Fittings, complete with the following auxiliaries:

Superheaters; desuperheaters; steel encased settings; breechings and stacks; soot blowers; oil burners; pumping, heating and strainer set; gas burners; combustion controls; air compressors; forced draft blowers and turbines; feed-water regulators.

Each boiler has full power rating 32500# and overload rating 65000# per hour. Design pressure 540 psi.; operating pressure at superheater outlet 490 psi. Temperature of steam at superheater outlet 620° F.

These boilers are in our warehouse at Jennings, Louisiana, unassembled, just as received from manufacturer. Can give immediate delivery. Price considerably below replacement cost. For further information and details write or call

The Superior Oil Company
Oil and Gas Building, Houston 2, Texas
Telephone Capitol 8131
Address Inquiries to H. R. Hansen

NEW GASO PUMPS

25 NEW GASO Fig. #1860, 2½″ x 4½″ Bore x 6″ Stroke (Removable Liners 4½″ in pump). Totally enclosed Duplex Power Pumps, Timkin Bearing Equipped, Side Pot Type Fluid Cylinder, Bronze Wing Guided Valves, Stainless Steel Piston Rods, Bakelite Piston Ring Packing, Complete with 28.8 PD 5-C Groove, 5-158-C V-Belts. All Weather Belt Guard, Mounted on Steel Skid. Powered with Model C36-6419 Industrial type 9-25A Chrysler 8 Cylinder Engine # 1657, 95 HP at 2400 RPM, 3¼″ Bore, 4⅜″ Stroke, Displacement 323.5, Complete with clutch, Penn Switch Battery & Steel Battery Box, tool box, mounted on steel skid, with spare parts, tools, connections, valves, gauges, valves & miscellaneous supplies, boxed for export—Pump Wt. 4310#. Engine Wt. 3640#, Pump Capacity—2½″ Liner 900# Sq. In. 46 bbls. per hour—3½″ liner 450# Sq. In. 93 bbls. per hour, 4½″ liners 350# sq. in. 160 bbls. per hour at 70 RPM. Engine Rating Continuous BHP 50 HP at 1200—68 HP at 1600—77 HP at 1800—95 HP at 2400 RPM. (Note: See Gaso Fig. #1849.) Packing list and price will be forwarded on request.

H. A. McCARTHY
310 Thompson Bldg., Tulsa, Oklahoma. Phone 5-3296